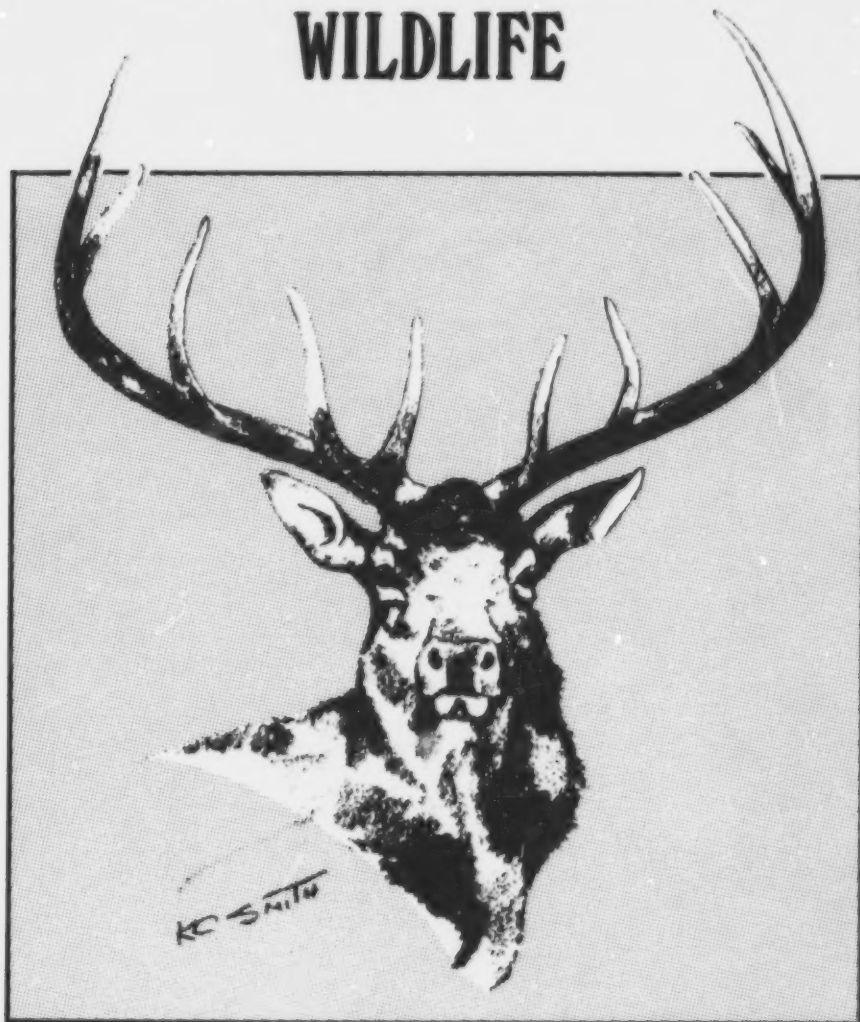


BIOPHYSICAL RESOURCES OF THE EAST KOOTENAY AREA WILDLIFE



MOE Technical Report 22



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November 14, 1986

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Lea, E.C. 1984. Biophysical Resources of the East Kootenay Area: Vegetation, Volume 1 (Regional Vegetation). Ministry of Environment, Kelowna, B.C. MOE Technical Report 5. 75 pp.

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Demarchi, D.A. 1986. Biophysical Resources of the East Kootenay Area: Wildlife. Ministry of Environment, Victoria, B.C. MOE Technical Report 22. 134 pp.

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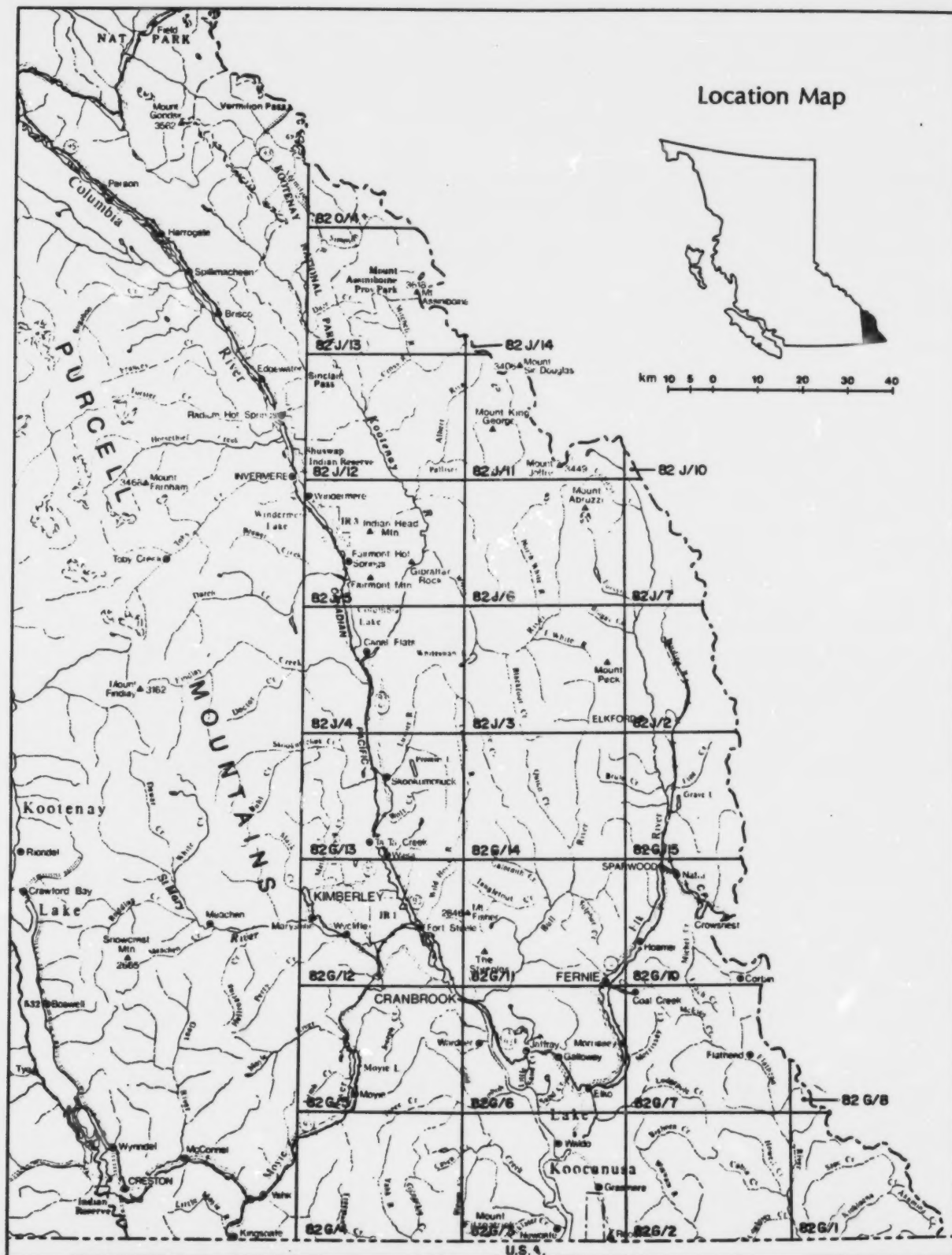
Lacelle, L.E.H. The Biophysical Resources of the East Kootenay Area: Soils.

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MOE Technical Report 22

**BIOPHYSICAL RESOURCES OF THE
EAST KOOTENAY AREA
WILDLIFE**

**Dennis A. Demarchi
WILDLIFE BRANCH**

**Victoria B.C.
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Frontispiece



FRONTISPIECE

Mule Deer bucks in early winter, by Keith C. Smith.

PREFACE

This report is one of a series of Surveys and Resource Mapping Branch (formerly Resource Analysis Branch) Bulletins that describes and analyses the biological and physical resources of the East Kootenay area. Individual bulletins share the same data base and focus on terrain, soils, climate, vegetation, wildlife, aquatics and outdoor recreation resources. A set of base data maps at 1:50 000 is also available for each discipline.

The East Kootenay study was initiated in 1975 in response to increasing land use conflicts resulting from social and economic growth in the region. Forestry, tourism, mining, and ranching, are all major contributors to the economic activity of the region. General population growth and maintenance of these industries requires that land be allocated for urban and industrial expansion and transportation corridors while, at the same time, preserving areas for wildlife and recreation.

The data, analyses, and interpretations contained within the East Kootenay bulletin and map series will assist in the development and implementation of a rational resource management and allocation policy. In addition, information presented in these publications will provide a basic understanding of the physical and biological components of land and water systems. It is anticipated that careful use of this data base will encourage the maintenance of a high quality environment in this part of British Columbia.

This wildlife report was written to provide an introduction to the wildlife, biophysical parameters and land use problems in the East Kootenay. The final chapter synthesizes information from many different disciplines presented in the preceding chapters in order to make habitat management recommendations aimed at achieving maximum densities of each ungulate species in the study area. This report does not recommend which of the seven ungulate species or competing land uses should be given management priority by the provincial government. Through an understanding of the biophysical processes and parameters, however, wildlife managers and planners should be better able to rationalize their priorities for management.

This report was received for publication on January, 1985.

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Director
Surveys & Resource
Mapping Branch

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Director
Wildlife Branch

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Chapter 1



PLATE 1

The Rocky Mountain Trench and Rockies from Skookumchuck, 1948.
(B.C. Government Photo, B.C. 577:77.)

CHAPTER 1 STUDY BACKGROUND

1.1 INTRODUCTION

The East Kootenay region is a mountainous area composed of three dominant land systems: the dry, steep-sided, high limestone Rocky Mountains in the east; the broad, plain-like valley of the Rocky Mountain Trench in the middle; and the wet, steep-sided, sedimentary and metamorphic Purcell Mountains in the west. These land systems are composed of a variety of landform features such as floodplains, high terraces, mountain slopes, avalanche tracts, rounded summits, cliffs, cirques, alpine ridges and glaciers. The East Kootenay region also has two major contrasting climatic regimes: the eastward flowing Pacific air masses that become drier as they pass over succeeding mountain ranges, and the air masses that flow in the Trench, bringing cold, dry Arctic air southward in the winter and warm, dry continental air northward in the summer. In addition to the warm, dry climate of the Trench, the inherent droughtiness of the soils there provides excellent growing conditions for many species of browse and herbaceous forage. Thus, many of the elements necessary for the production of a variety of native ungulates are met in this ecologically diverse region.

The East Kootenay region is unique in British Columbia in its capacity to support a wide variety of ungulates. Seven species are indigenous to the study area: Rocky Mountain elk¹ (Cervus elaphus nelsoni), mule deer (Odocoileus

hemionus), white-tailed deer (Odocoileus virginianus ochoturus), moose (Alces alces andersoni and A.a. shirasi), Rocky Mountain bighorn sheep (Ovis canadensis canadensis), mountain goat (Oreamnos americanus), and woodland caribou (Rangifer tarandus caribou). This diversity, coupled with the capability to support large numbers of most of these species as well as several species of large carnivores, makes the East Kootenay a wildlife area of national significance (Pearse and Bowden 1966, Benson 1970).

Wildlife, however, is only one of the many resources of the East Kootenay region. There is an active forest industry with accompanying lumber mills and one pulp mill. Active lead and zinc mining has been carried out for many years at the Sullivan Mine in Kimberley, as well as underground coal mining in the Crowsnest Pass area. In the last 15 years, open pit coal mining has been developed in the Elk and Fording River and Michel and Corbin Creek areas and more are being planned in the Upper Elk and Flathead valleys. Hydroelectric developments have also had an impact on the land base in the East Kootenay. The first major project in the study area was the Koocanusa Reservoir, formed by the hydroelectric dam located near Libby, Montana. Proposed developments are the Kootenay Diversion, a plan to divert water from the Kootenay River at Canal Flats into the Columbia River system, and a thermal generating plant within the Elk Valley area. Ranching also plays a role in the East Kootenay. This is primarily

¹ Mammal names follow Banfield, 1974 except that the name Rocky Mountain elk or elk which is preferred by the author over the name wapiti which was recommended by Banfield.

confined to the Rocky Mountain Trench and the Elk Valley. In most cases, grazing allotments are located on low elevation wildlife winter ranges. Tourism, a growing industry in the East Kootenay is primarily associated with outdoor recreation (i.e. hunting, fishing, hiking, and downhill skiing). All of these industries represent potential conflicts with the wildlife resource both directly and indirectly. Direct impacts result from the destruction of habitat or the alteration of habitat to such an extent that its capacity to support wildlife is reduced. Indirect conflicts, such as the alienation of more land as well as increased harassment of wildlife, result from the increase in population that accompanies the developments.

In an area of such diverse interests resource conflicts are constantly arising. The resolution of these depends on the information available to resource planners and managers. A baseline wildlife habitat inventory forms part of the necessary resource information for the management and protection of wildlife and their habitat. There already exist several studies focusing on the wildlife and wildlife habitat resources of the East Kootenay. In 1965 the East Kootenay region was mapped at 1:250 000 scale for ungulate capability (Blower, et al. 1969 and 1970) using the Canada Land Inventory (C.L.I.) system of ungulate capability classification. That data was used in the subsequent Land Capability Analysis (Benson 1970).

Conflicting demands for natural resources created a need to update existing resource data and to inventory at a more detailed scale (1:50 000) than that provided by the aforementioned Canada Land Inventory and Land Capability Analysis projects. Consequently a climatological data network was established by the Air Studies Branch; surficial materials and landforms were analysed by Ryder (1981); soils data were further improved by Lacelle (in press); vegetation (forest zonation) was studied by Lea (1984); outdoor recreation information was updated from previous studies by Collins (1981); aquatic resources were studied and analysed by Shera (in press); and this wildlife biophysical study was undertaken. These studies shared a common mapping scale of 1:50 000 and a common level of survey intensity.

1.2 MAPPING DATA BASE

The Biophysical mapping techniques that were employed in this study follows the standard method developed by the Surveys and Resource Mapping Branch, Ministry of Environment. This method has been reported in several position papers: Demarchi et al. (1980), reported on the mapping of ungulate capability to the Northwest Section meeting of the Wildlife Society; Demarchi et al. (1983) developed a position paper on wildlife capability classification; and Walmsley (1976) reported on the philosophy, techniques and application of biophysical land classification in British Columbia.

The biophysical mapping approach used in this study is an incremental

process beginning with the two most fundamental needs of wildlife - food and cover. These attributes are partially identified from soils, terrain, and vegetation mapping done by other services of the Terrestrial Studies Section (Ryder 1981; Lea 1984, Lacelle in press). Land units selected from these maps and judged (as described below) to have different capabilities to support ungulates form the basis for mapping of wildlife (ungulate) habitat. For ungulates, the most important habitat separation is by seasonal use categories. As winter range in the area is considered to be a major limiting factor for ungulates, this project identified those lands which have a winter range capability, as opposed to lands which are used during other seasons. Subsequent steps in assigning capability included the assessment of a number of environmental conditions influencing ungulate capability. Some of these conditions are ephemeral and influence different species in different ways; other environmental conditions reflect the degree to which land is capable of sustaining favourable forage that is needed by specific ungulates.

1.3 OBJECTIVES AND APPLICATIONS

The main purpose of this wildlife capability inventory has been to improve the identification and classification of the physical and biological features of the East Kootenay area that relate to the production and well being of native wild ungulates. This was done according to the provincial wildlife capability mapping scheme outlined in Chapter

Two. More specifically, the objectives of this study were to define habitat requirements; develop a habitat capability rating for native wild ungulates; and prepare management recommendations for each species in each habitat. This report provides background information about the physical and biological resources in the study area; a description of the potential distribution of the native wild ungulates and their habitat requirements; and comments on the management and protection of the required habitat for the native wild ungulates.

The report outlines the potential options available in order for the Ministry of Environment to manage the various ungulate species in the study area within the concept of habitat capability. The Ministry of Environment has prepared five reports that delineate planning options for wildlife management within the constraint of current land use and management policies. Each of these reports (including this one) serves a specific purpose that will result in good wildlife management if implemented. In order for the provincial government to determine what habitats it can or will manage it must first understand what potential there is for management; this report will serve that purpose. Then, once it understands what it could produce, the government must then conduct an analysis to determine the feasibility of such management options and to consider the suitability of these management options; see Elk-Flathead, Southeast Kootenay and Upper Columbia Strategic Planning Unit Studies (B.C. Ministry of Environment 1983 and

1984, Tipper 1983) and Land Use Plan for the Southern Rocky Mountain Trench - Wildlife (Tipper 1979). Finally, specific recommendations as to the programs to be implemented must be developed; see East Kootenay Wildlife Management Plan (B.C. Fish and Wildlife Branch, in press).

This wildlife report will allow management and planning agencies concerned with wildlife to locate, identify and compare areas of wildlife significance for development, preservation and/or enhancement. Data from the current wildlife project have already been used to assess urban development and transportation corridors in the Fernie and Flathead Basin (Walmsley 1977); and settlement suitability studies in the Cranbrook (Howell Jones, ed. 1980) and Windermere-Invermere (Howell Jones, ed. in press) municipal planning areas.

The 1:50 000 ungulate biophysical capability maps (available from MAPS B.C., Surveys and Resource Mapping Branch, B.C. Ministry of Environment, Victoria, B.C.) will be useful in making specific management decisions. These maps reflect the capability of the habitat to support ungulates, and are thought to be useful in identifying areas which currently produce wildlife as well as habitats that have the potential to support ungulates through management, enhancement or protection measures.

Chapter 2

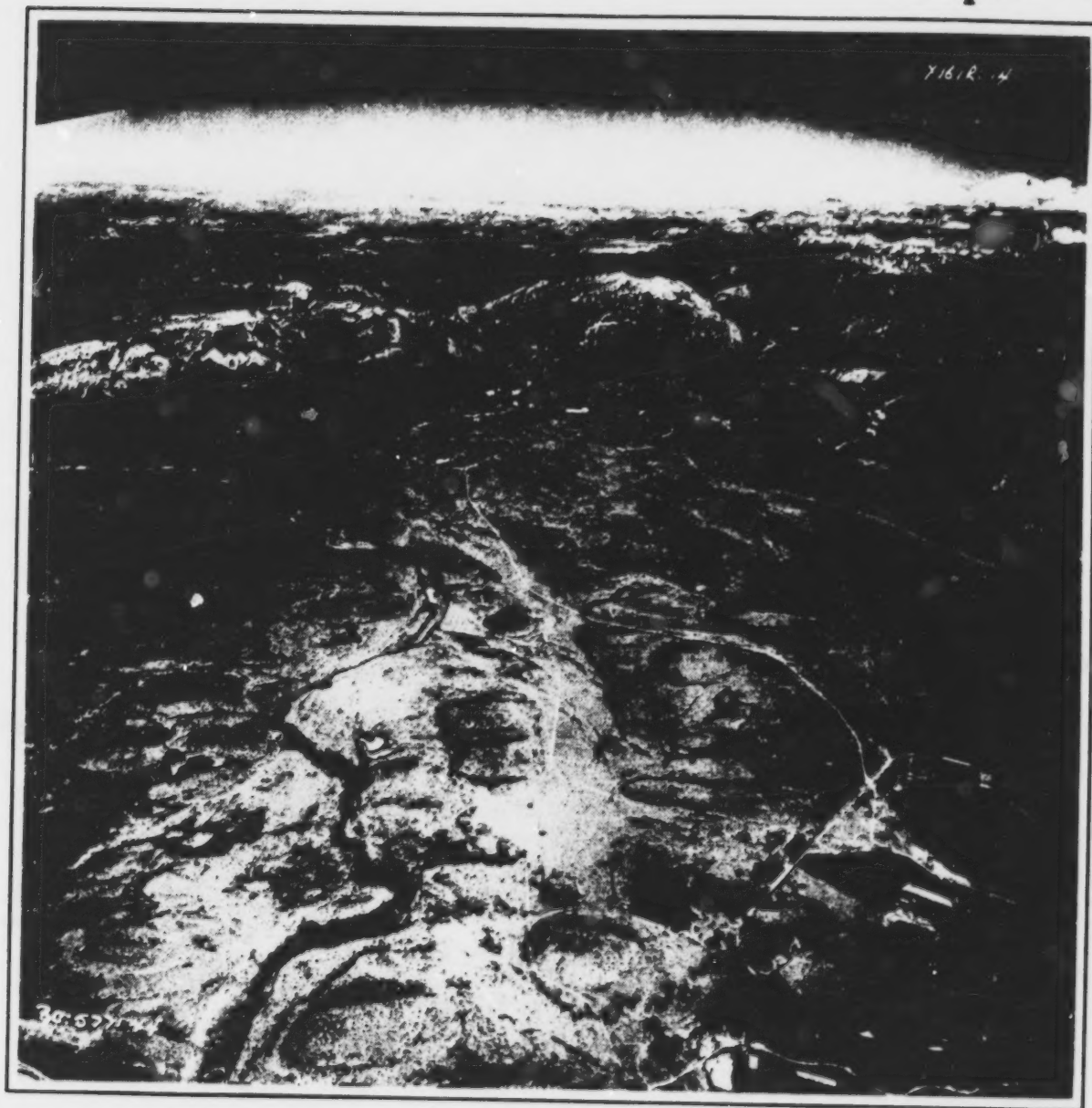


PLATE 2

The Rocky Mountain Trench and Rockies from Baynes Lake, 1948.
(B.C. Government Photo, B.C. 577:44.)

CHAPTER 2 LAND USE HISTORY AND DEVELOPMENT

Any discussion of wildlife resources and capability of the habitat to support wildlife should be placed in an historical context of land use development. Capability has been defined as the ability of the land to support a given resource (in this case ungulates) under specified management options (see Section 5.2). The options available to the manager of wildlife in the 1980s has been dictated in part by the development of cultural patterns and past resource exploitation. It seems beneficial, therefore, to summarize the resource use history of the East Kootenay region. And, because the resource use philosophy and activities which affect the study area are larger than that area, for the purpose of this section the discussion on land use history and development will include the Rocky and Purcell Mountains and Rocky Mountain Trench south of the Canadian Pacific trans-continental line to the International border.

2.1 ABORIGINAL PEOPLE

There is no solid evidence of the occupation of the study area by aboriginal people prior to or during the period of 10,000 - 5000 B.C. The first evidence of occupation probably dates from the latter part of the period between 5000 B.C. and A.D. 500 (Sneed 1978).

Most of the archaeological sites studied in the Rocky Mountain Trench date to the period of A.D. 500 - 1880. The time and place of origin of the Kutenai (also referred to as

Kootenae or Kootenay) Indian remains unknown. They may have been a western Indian that developed some plains cultural patterns and included part of the short grass prairie in their hunting territory; or, they may have been a Plains Indian that were forced westward over the Rockies, but were able to maintain part of the short grass prairie in their hunting territory (Masten et al. 1981, Sneed 1977, Bussey 1977).

In addition, Aboriginal people occupied the Crowsnest valley as far back as 6000 B.C. These were people of a mountain/foothill culture which was distinct from that of the Plains Indian. These Indians were displaced about 5500 B.C. and the new plains culture remained until 1500 B.C. After that period the Indians of this area show traditions that are similar to both the Plains and the Kutenai Indians (Bussey 1977).

At the time of Euro-American contact the Kutenai people were inhabiting a territory that extended from the Blaeberry River to the Arrow Lakes to the Pend d'Oreille River and to Flathead Lake (Turney-High 1974). Prehistorically, the cultural center of the Kutenai was at Tobacco Plains at the southern limit of the Rocky Mountain Trench (Masten et al. 1981). At some time during the aboriginal period the Kutenai peoples divided into two separate bands. The Lower Kutenai migrated west; the Tobacco Plains people or Upper Kutenai remained. The Upper Kutenai were located at Windermere Lake, St. Mary's River, the Elk Valley and

Tobacco Plains. Turney-High (1974) estimated that in 1825 there were 500 Upper Kutenai Indians, of which 200 belonged to the Windermere band.

In very early times the Upper Kutenai were without permanent campsites, moving from small summer campsites to winter camps. However, with the acquisition of the horse in the early 1700s (Haines 1938), there was a tendency for them to establish permanent bases from which they could move in different directions (Masten et al. 1981).

Aboriginally, the principle means of sustenance for the Kutenai was wild vegetable gathering, berry collecting and big game hunting. Fishing and small mammal hunting were also significant, but to a lesser extent. At times the Kutenai, Pend d'Oreille and Flathead tribes joined forces to hunt bison on the short grass prairie (Johnson 1969 and Masten et al. 1981). The increased mobility that the horse afforded enabled long-distance travel, and hunting trips to the Prairie and Great Plains became established events during the late summer and winter.

In about 1835-1845 a band of Shuswap Indians from the North Thompson River valley immigrated to Windermere Lake, displacing the resident Kutenai Indians. They maintained contact with other Shuswap tribes, through annual treks back to the North Thompson River valley. By 1850, there were about 150 people in Chief Kinbasket's Windermere band (Sneed 1978).

2.2 EURO-AMERICAN EXPLORATIONS

Early exploration by the fur traders occurred during a period of active deglaciation, the resulting deep persistent snows impeded their progress in discovering passes across the Continental Divide. In 1807, after seven years of trying, David Thompson finally crossed the backbone of the Rockies into the Columbia River valley, and became the first European to do so at this latitude (Hopwood 1971). He established a fort on the west bank of Toby Creek and in 1807 and 1808 he explored the upper Kootenay River and the Moyie River as far downstream as Kootenay Lake. He established a trading area that extended from the Spokane River, Coeur d'Alene Lakes, Clarks Fork and Flathead Rivers northward. Furs were collected from the Indians and carried over the Rockies to Rocky Mountain House via Howse Pass in the summer.

Thompson's journals give several examples of uses made of the ungulate resources. He writes "At the latter end of autumn, and through the winter, there are plenty of red deer [elk] and antelope [mule deer], with a few mountain sheep. The goats with their long silky hair were difficult to hunt, from their feeding on the highest parts of the hills... during the summer and early part of the autumn very few deer [elk] were killed; we had very hard times and were obliged to eat several horses... At length the salmon made their appearance, and for about three weeks we lived on them; at first they were in tolerable condition, although they had come upwards of twelve hundred miles from the sea... But as the spawning went on... they became poor

and not eatable; we preferred horse meat... As soon as the mountains were passable [in 1808] I sent off the clerk and men with the furs collected, among which were one hundred of the mountain goat skins... January 11, 1809 - As there is now plenty of shore ice of sufficient thickness we made a glacier for frozen meat... in this we placed 160 thighs and shoulders of red deer [elk] and forty-seven thighs of antelopes [mule deer]; this is necessary, for soon as the fine weather comes on the deer of all species leave the lowlands, and retire for fresh grass and shelter to the valleys of the high hills... On the seventeenth [of January, 1809] the Kootenay hunters brought six red deer [elk] which I had split and dried for summer provisions...". He had stored a minimum of 46 elk and 12 mule deer for summer use.

In 1811 Thompson made his final push to the mouth of the Columbia River and in July he arrived at Astoria. In May, 1812 after five years in the Kootenay Valley, he crossed the Rockies for the last time as he headed for Montreal (Hopwood 1971).

Joseph Howse, representing the rival fur company, the Hudson Bay Company, travelled to Tobacco Plains in the fall of 1810. He had been sent out to investigate the activities of the North West Company west of the Rocky Mountains. He established at Tobacco Plains the first Hudson Bay outpost west of the Rockies. However in 1811 he departed eastward across the mountains, having concluded that the route was not

feasible (Graham 1963).

After this initial period, fur trading continued but settlers soon followed. About seven years after Thompson's departure Francois Morigeau arrived and became the first white settler to take up permanent residence in the Rocky Mountain Trench. He established an amiable relationship with the Indians and married one of Chief Kinbasket's daughters.

Information regarding the East Kootenay is sparse during this early period of white settlement, since most of the settlers did not keep journals. Trapping and trading must have continued, however, because in 1841 Governor George Simpson made a tour of trading posts throughout the region.

2.3 SETTLEMENT

Almost from the beginning, the European immigrants tried to settle and grow crops in the Rocky Mountain Trench. Although early fur traders were interested in keeping the country "wild" with the view of keeping a steady supply of furs and keeping rival fur companies out, they had to develop outposts to facilitate trading. At first the traders and settlers integrated themselves with the Indians of the area. However, the white man soon demonstrated the desire to stake out the boundaries of "his" property, and they often located themselves on sites that had been claimed by the Indians. For example, Edmund Johnston tried to defend his newly staked "farm" by facing the Indians down. The



PLATE 2.3.1

The original objective of the provincial government was to settle all the valley lands; many farms were not either suitably located to markets or large enough to be viable operations and were subsequently abandoned or amalgamated into larger units. An abandoned farmstead at Dorr.

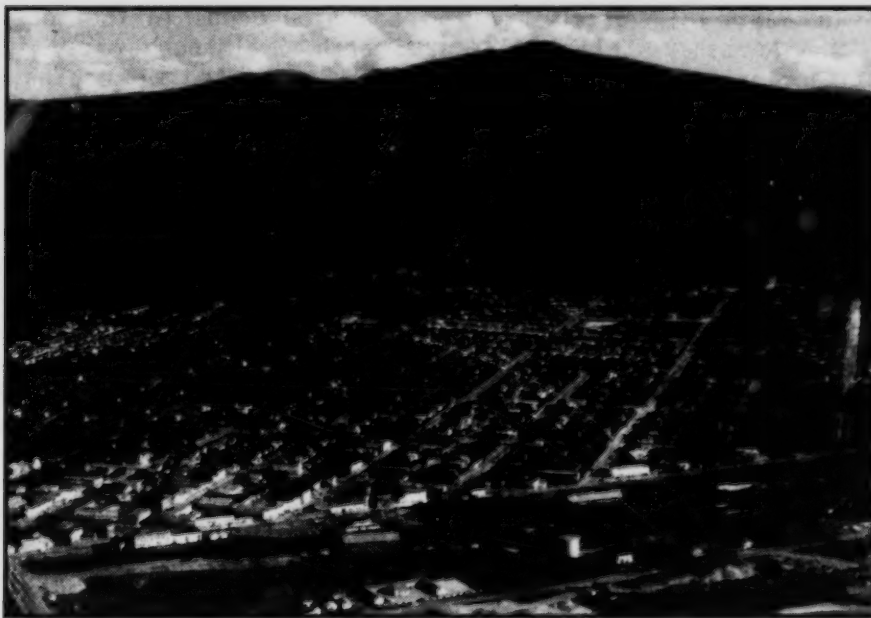


PLATE 2.3.2

The city of Cranbrook is located on Joseph Prairie, originally a traditional homesite for a band of Kootenai Indians; this site was later pre-empted by the Galbraith Brothers. Prior to the urbanization of this area, it had high potential as winter range for elk, moose, white-tailed deer and mule deer.

Indians gave in, but Johnston moved to the west side of Lake Windermere anyway (Graham 1963).

In 1887 Sam Steele and a troop of Northwest Mounted Police were sent to the Rocky Mountain Trench with the purpose of establishing law and order between the white settlers and the Indians. The prospectors and entrepreneurs were quite lawless themselves, but, because the Indians were rebelling against the settlement of their traditional hunting and camping areas, Steele was sent to settle the disputes (Steele 1915). Steele was a good negotiator: for example, he was able to convince the local chief (Isadore) to give up the traditional Indian homesite at Joseph Prairie (the site of the City of Cranbrook) to white settlers, the Galbraith brothers.

As early as 1883 the Kootenay Indians had awaited the arrival of a commissioner from the provincial government who would define their

reserves and so put a stop to the extensive encroachment by pre-emptors on lands the Indians perceived to be their own (Cail 1974). However, in 1888 when the land surveyors actually surveyed the reserves, the Indians were upset because the reserves were too small; they had been promised larger lands. But, as no formal treaty had been made nor any records kept of the transactions, it fell to Steele to induce the Indians to be satisfied (Steele 1915).

The prevalent European notion and the objective of the provincial government was to settle the valley

and farm all available lands (Cail 1974). Wheeler (1912) wrote that, once the Transcontinental and Crow's Nest Pass railways were completed, the Trench would be settled by an agrarian population. He stated that some 18,210 hectares were owned by the Columbia Valley Irrigated Fruit Lands Company, a colonizing company that sold its lands directly to settlers. That this was the commonly held philosophy of the times is indicated further in the book written by Lees and Clutterbuck (1892), who state that they explored the Rocky Mountain Trench in 1887, with the view of examining the possibilities of settling English public school graduates.

By 1913, 7,565,597 hectares had been alienated within the province. Since railway companies receiving land grants could select their subsidy lands, Cail (1974) suspects that this was the best land, including most of the arable land in British Columbia. He further ponders whether British Columbians have received a fair return for their lands. Transportation was vital to the province within the framework of Confederation, but the price was high.

Baillie-Grohman in the period of 1883-1888 was granted 19,426 hectares of land in the Creston valley in order to build a canal that would divert the Kootenay River into Columbia Lake. The Canadian Pacific Railway became concerned over the added flows to the Columbia River, and so Baillie-Grohman was granted a further 12,141 hectares in the Rocky Mountain Trench for the construction of a lock on the canal. A year later



PLATE 2.3.3

With the construction of the dam at Libby, Montana, in the mid-1970's, the flooding of the Kootenay River destroyed much valuable riparian habitat and is a barrier to ungulates that need to migrate across the Rocky Mountain Trench in this area.



PLATE 2.3.4

In the East Kootenay Region the valley bottoms of the Trench and the Elk Valleys have the most intensive land use demands; they are also the areas that can support the densest populations of ungulates during the critical winter months. Planning and recognition of wildlife's needs for critical habitat is necessary in order to maintain this valuable resource.

he was granted \$2,500 in order to close his canal (Cail 1974).

In 1893 the British Columbia Southern Railway was granted 1,519,945 hectares to construct a railroad from Fort MacLeod, Alberta, to Kootenay Lake. Before the line was completed the company itself granted 20,235 hectares of valuable coal lands to the Dominion Government in return for a cash subsidy of \$6,215 per kilometre of railroad (Cail 1974). The federal government still controls the coal mining on those lands, while 103,200 hectares of the original crown granted lands in the Elk Valley are still in the control of the successor companies to the British Columbia Southern Railway.

By 1913, the Land Policy for British Columbia had reached a watershed. No longer were large grants given for transportation developments; instead monies were to be offered (Cail 1974). But land grants did not end in 1913. In 1953 the provincial government established the system of Tree-Farm Licences (Forest Management Licences), which was to involve a transfer of rights and responsibilities from the Crown to licensees of such a scope that it was similar to a Crown grant of zoned forest land (Pearse 1976).

In 1953, Tree-Farm Licence 13 was established in perpetuity, consisting of 37,354 hectares in the Bull River watershed. Adjacent to the study area in the Spillamacheen River watershed, Tree-Farm Licence 14, consisting of 139,500 hectares, was established in 1954, in perpetuity.

One of the larger impacts on the slowing down of settlement of lands in the Trench has been the impoundment of the Kootenay River from Libby, Montana to Wardner, B.C. From 1947 until the mid 1970s Crown land in the "Libby Pondage" area was withheld from public sale, pending the settlement of those lands to be flooded. The drowning of the Kootenay floodplains resulted in the provincial government buying all lands that were to be flooded and all property of land owners whose greater portion of lands was to be flooded.

The provincial government of the time originally intended that those land owners who were to be flooded and who also had a desire to relocate would have first options on adjacent Crown lands. By the time this matter was resolved, the public at large felt that the benchlands should not be further alienated. Demands for lands for grazing and wildlife uses were so great that many land holdings were bought outright with no option of relocating on adjacent Crown land, except for homesite properties at Baynes Lake.

2.4 TRANSPORTATION SYSTEMS

Road access to the East Kootenay started with the Dewdney Trail in 1888. The first motor road to cross the Rockies in this region was the Banff-Windermere Road, completed in 1922. The Big Bend Highway to the Interior Plateau region of the province was completed in the 1930s. In 1949 the Trans-Canada Highway Act was passed to assist in the building of a hard-surfaced, all weather road



PLATE 2.4.1

Prior to the construction of railroads in the East Kootenay, the river systems were seen as a means of transporting raw material and goods. In order to facilitate shipping between Golden, B.C., and Jennings, Montana, a canal was dug at Canal Flats to join the Kootenay and Columbia Rivers. Photo circa 1888. (Photo credit: W. A. Baillie-Grohmann, from B.C. Provincial Archives).



PLATE 2.4.2

Transportation systems in the 1800's and the early part of the 20th Century were more restrictive and were gentler to the land base. Here a group of four-horse teams (4-ups) are hauling hay into an active logging area in the Upper Moyie River Valley, circa 1922-1930. (Photo credit: W. F. Montgomery, from B.C. Provincial Archives.)

across Canada (Guillet 1966). In 1962 the highway across the Selkirk Mountains at Roger's Pass was completed, greatly increasing vehicle access to the Rocky Mountain Trench, particularly in the winter months. By the mid-1960s, the southern trans-provincial highway was built between Salmo and Creston, which further facilitated access to the East Kootenay.

From the 1850s to the 1880s surveyors such as Moberly, Palliser, Hector and Dawson had been busy cataloguing the passes, the geology and the vegetation of the region. Their intention was to find access routes that would enable the region to be opened up to settlers and developers (Dawson 1886).

Until the completion of the transcontinental railway in 1887, access to the East Kootenay was by horse in the summer and snowshoe in the winter (Steele 1915). In 1887 a wagon road was cut from the rail line at Golden to Wildhorse Creek. In 1886 the first steamboat had plied the Columbia River from Donald to Columbia Lake (Downs 1971). The completion of the Grohman canal and locks at Canal Flats allowed several steamboats to enter the Kootenay River where they provided transportation between Fort Steele and Jennings, Montana. Only one steam-wheeler, the Gwendoline, ever made a return trip through the canal (Downs 1971).

The British Columbia Southern Railway, completed in 1898, soon took over as the principle means of car-made a return trip through the canal

(Downs, 1971).

The British Columbia Southern Railway, completed in 1898, soon took over as the principle means of carrying goods and freight into and out of the southern portion of the Trench (Downs 1971). The last steamboat left Fort Steele and the upper Kootenay River in 1901.

2.5 GRAZING ON CROWN LAND

There is a long history of domestic livestock grazing in the East Kootenay region. Horses were probably first brought into the area by the Kutenai Indians in the early 1700s (Haines 1938) nearly 100 years before the first white explorers arrived. The Indians acquired large numbers of horses; for example, in 1858 Captain John Palliser estimated that one Indian camp alone had about 45 horses per family (Graham 1963). Horse use of the native ranges continued until the 1940s and 50s when a government program was implemented to remove feral horses from the region. During the roundup years, 2500 horses were captured by the British Columbia Forest Service (Demarchi et al. 1969).

Cattle were introduced in the Rocky Mountain Trench by James Sinclair and his party during two emmigration excursions through the area in 1841 and 1854. While in this area they traded some cattle for horses from the Kutenai Indians (Graham 1963). In order to feed the miners in the district, notably at Findlay and Wildhorse Creeks in the 1860s, large numbers of cattle were



PLATE 2.5.1

Past livestock grazing reduced most of the accessible forage from ranges in the Rocky Mountain Trench. This fence-line contrast on the Tata Creek Range unit in 1970 shows that the forage potential of most ranges was not achieved with abusive grazing practices.



PLATE 2.5.2

In the mid-1970's provincial range administrators adopted a planning system called Coordinated Resource Management Planning, whereby the Ministries of Forests, Environment and Agriculture and Food developed grazing plans in concert with the ranchers. Many ranges, such as this grassland at Four Mile Creek, have been rehabilitated since the mid-1970's.

driven into the area from Salt Lake City, Utah and Lewiston, Idaho. With the decline in the mining activity in the late 1860s the demand for beef fell, but picked up again with the construction of the railroads in the 1880s and 90s. One company alone brought in 3-400 head per month via the Crow's Nest Pass, in order to feed the construction workers (Bawtree and Milroy 1957).

From the mid to late 1800s settlement and homesteading increased and cattle, horse and domestic sheep grazing occurred on the Crown ranges without control and without government license. In the 1930s, after large forest and slash fires, a series of extensive areas of herbaceous growth became established in the study area. This resulted in an expanded use of the Crown lands for grazing. But whereas in the past livestock roamed free and generally uncontrolled, in the 1930s livestock required a permit in order to graze Crown land. (The Grazing Act was passed in 1919.) Generally, the permits were issued on a "season-long" basis, that is from when the snow melted until it came again.

In the 1940s and 50s the government emphasized cattle grazing so that horses and domestic sheep grazing of Crown ranges were phased out. As the horses and sheep were removed from the ranges, the number of cattle grazing permits was increased and continued to do so. They did not peak until the Libby Pondage "problem" became a subject of public concern in the 1970s. An additional problem was the number of cattle that

grazed in trespass at all seasons of the year. In some cases, this amounted merely to an early turnout or late roundup and yet in other instances it indicated a deliberate disregard for the grazing regulations. In the 1950s and 60s, trespass grazing probably accounted for up to 30 percent of the legitimate grazing (Demarchi et al. 1969).

Conflicts between wildlife and livestock interests became acute in the 1960s, with the two resource groups that had the lowest status for Crown land use in the province arguing over an unmanaged forage resource on a diminishing land base (Paish et al. 1970). But in the 1970s two significant changes occurred. The government of British Columbia purchased several ranches and retired their existing grazing permits in favour of wildlife use, to relieve the overstocking of Crown range by livestock and provide flexibility in the grazing management scheme. This improved range conditions and benefited both wildlife and domestic stock. Then, under a new government administration, a program of deferred rotation grazing and Coordinated Resource Management Planning was implemented to manage the forage resource for livestock and wildlife (Anderson 1967 and Pitt 1982). For the first time, wildlife was given formal recognition as a user of Crown land and forage, necessitating other resource users to accommodate wild life, to some degree, in their planning and management.

2.6 METAL MINING

In the early 1860s, gold was discovered in several places in the Kootenay and Columbia valleys. In 1861, gold was discovered in Canyon Creek near Golden, and, in 1863, in Findlay Creek and then Wildhorse River. News of the discovery spread to the diminishing gold fields of California so that in 1864 there were about 3000 miners on the Wildhorse field, about 100 on the Findlay field and several hundred prospecting other areas (Iverson 1930, Smyth 1942). Subsequently other gold fields were discovered in Perry Creek and the Moyie watershed.

The Wildhorse River was the site of a large population of prospectors. This flurry of activity continued until 1870. Each summer thousands of prospectors would work the gravels and then during the winter most would leave for the glamour and excitement of large cities, particularly San Francisco (Smyth 1942, Graham 1963).

The mining method involved washing gravel to obtain the gold. In most streams the operations were small and very little gravel was moved. In the Wildhorse River field, however, hydraulic mining was used to wash the entire floodplain, causing complete destruction of the original habitat (Steele 1915).

In 1892, the lead, zinc, and silver ore bodies of the North Star and Sullivan properties were discovered and were followed by the discovery of the St. Eugene property on Moyie Lake. From 1893 until the British Columbia Southern Railroad

was completed in 1898, ore was freighted by steamwheeler from Fort Steele (the new name for the Wildhorse Creek townsite) to a railhead at Jennings, Montana (Downs 1971, Smyth 1942).

Prospecting has continued to the present and several properties have been worked, but most have not been successful. The Sullivan Mine is still producing and is the main economic base of Kimberley. Copper was open-pit mined for several years in the late 1960s and early 1970s at the base of the Steeples at Burntbridge Creek with two of three known anomalies being exploited. Although several attempts have been made, mining has not been as successful in the basin of Tracey Creek. Gypsum mining is being economically mined in Windermere Creek, and a new gypsum mining operation was initiated in the upper Lussier River watershed in 1983.

2.7 COAL AND OIL MINING

The following section on coal mining has been selected from Dick (1978) who based his account on historical sketches by Rickard (1942) and Newmarch (1953).

Coal deposits in the Elk Valley had been known for some time prior to their development in 1887; however, little interest was taken in the initial explorations due to the lack of a transportation system. In the 1890s a Victoria based syndicate obtained a charter to build the British Columbia Southern Railway (which is commonly referred to as the



PLATE 2.6.1

The Sullivan Mine at Kimberley does not occupy as much land as does the town needed to accommodate the miners and support workers. General view of the surface workings, 1945. (Photo credit: B.C. Provincial Archives.)



PLATE 2.6.2

In the quest for gold, hydraulic working of the fluvial deposits of the Wildhorse River destroyed potential winter and summer ungulate habitat, photo circa 1924-25. (Photo credit: B.C. Provincial Archives.)



PLATE 2.7.1

Coal mining in the Elk Valley in the early part of the 20th Century was restricted to underground mining. The surface disruption was limited to the coking ovens and houses needed for the miners; photo of the Corbin Creek Collery circa 1920. (Photo credit: B.C. Provincial Archives.)

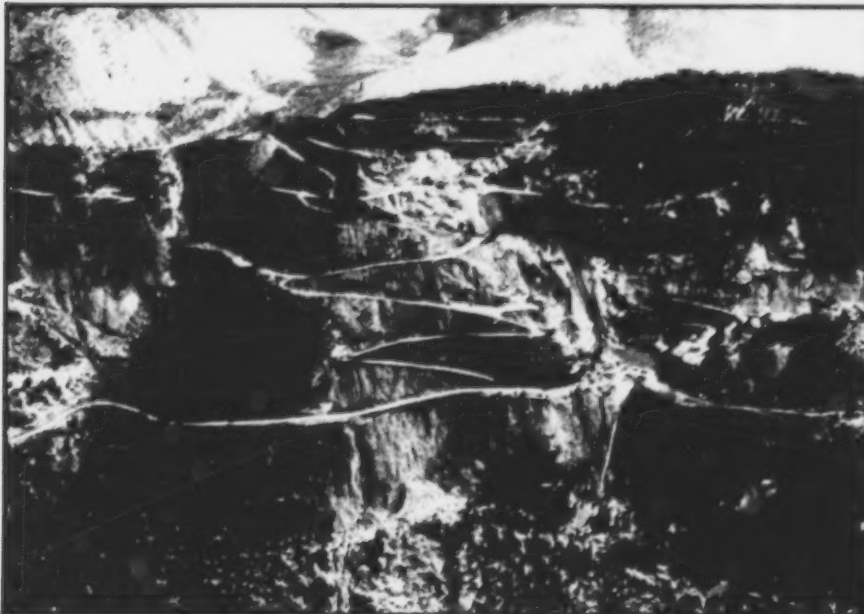


PLATE 2.7.2

In the 1970's, with the advent of large machines, surface mining of the coal deposits became the normal extraction process. Such mining methods have a greater impact on the land base and other resources than occurred in the past. Not only is there disruption from the houses and infrastructure, but also the mine and over-burden deposit areas.

Crow's Nest Pass Railway) from Fort MacLeod, Alberta, to Kootenay Lake. Six mines had been opened in the Coal Creek Valley by 1903.

The Great Northern Railway Company bought into the Crow's Nest Pass Coal Company in 1901 and constructed a rail line from Michel to Gateway, Montana. This line provided access to new coal markets. In 1911 a seventh mine opened in Coal Creek. The Coal Creek Collieries were worked continuously until 1958 when they were finally closed.

Concurrent with the production from the Coal Creek Mines, the Crow's Nest Pass Coal Company undertook developments at both Morrissey and Michel Creeks. At Morrissey, eight mines operated from 1902 to 1909, at which time the seams were determined to be too dangerous to work. The Michel Colliery has been in continuous production from 1898 to present.

The Canadian Pacific Railway opened the Hosmer mines in 1906, but sharp folds and extensive faulting forced the colliery to be shut down in 1914.

In 1908 a colliery was established in Corbin Creek. This was the site of the region's first surface mine which opened in 1913. The surface operation contributed to the output of the mine from 1913 to 1920 and from 1926 to 1935 when a violent labour dispute forced the company to abandon the mine. The surface mine was reopened from 1943 to 1948 and then lay dormant until 1974 when Byron Creek Collieries resumed mining

of thermal coal.

In the late 1960s and early 1970s, a renewed interest in the mining of metallurgic coal began and several companies obtained licences to mine several properties. Exploration for new coal deposits was vigorous. Kaiser Coal Company began to strip mine Harmer, Michel and Natal Ridges; Fording Coal Company opened a large strip mine in the upper Fording River and established a company town at Brule Creek (Elkford). Several companies are at present trying to identify the coal resources and potential products; sites for these properties are at Weary Creek, Line Creek, Greenhills Range, located in the Elk and Flathead valleys.

Exploration for oil in the lower Flathead River valley has been carried on spasmodically since 1900. In 1930 three companies were active, and exploration centred on the Lower Sage and Akamina Creek valleys (Andrews 1931). The 1980s has seen a renewed interest in finding oil deposits in the Lower Flathead River valley.

2.8 FORESTRY

Logging on a large scale probably had its beginnings in the East Kootenay in 1886 when a sawmill was transported up the Columbia River to Canal Flats by Baillie-Grohman (Downs 1971). However, it was not until the period of 1896-98, when the British Columbia Southern Railway was being constructed, that lumber was being cut for outside markets. A mill was established at Wardner to

supply lumber and ties for the railroad (Smyth 1942).

Initially logs were hauled by teams of horses or floated down the Kootenay River to the mills. With the advent of rail transport in the Trench, track was extended into the forests and the logs were hauled to mills by rail (Iverson 1930, Smyth 1942). Railways were used in logging enterprises throughout the Trench between the Lussier River and the International border (Ross 1976).

Logs were also transported to the mills by flume and an 18 mile flume at Lumberton was reported to be the second longest in North America (Scott and Hanic 1974). Smaller flumes were also in use, primarily in Alexander Creek.

In the early 1900s the B.C. Forest Service surveyed all the rivers in the East Kootenay with the view of using them to drive logs to the mills (Hodging 1931, Andrews 1931, Gold 1913). The main rivers to be driven were the Bull downstream from Galbraith Creek, the Elk and the Kootenay River.

At first the use of the forest resource was purely exploitive, with large volumes of wood being removed to supply ties for expanding railroads in B.C. and on the Prairies; props for mine shafts and lumber for construction. In the 1920s a series of trails, cabins and lookout posts were established and manned with fire suppression crews, with the view of "protecting" the forests from fire (Hodging 1931, Andrews 1931).

No plans were made to replant or otherwise manage the forests. Forests were considered to be an extractive resource up to the 1970s when examples of destructive and cut-and-get-out logging were still occurring (Utzig and Herring 1975). It was not recognized by government that forests required land and sound management in order to be perpetuated. Forest surveys were conducted with the objectives of determining the volume of the standing crop, establishing fire protection systems or locating agricultural areas (Gold 1913, Hodging 1931, Andrews 1931).

From the outset logging in the study area cut the more accessible trees first. In part this was dictated by the transportation costs; but also it was because the prevailing attitude throughout the forest industry was that the forests were boundless. It seemed as if the trees could not be harvested fast enough to deplete the supply. Similarly, land alienation and forest clearing for settlement were not thought to have a deleterious effect on the wood supply. Nor was there much thought given to the fact that the prime Douglas-fir growing sites were the ones that were being depleted first. At the same time, it was those sites that were receiving the impacts of competing land uses.

Technology for cutting and hauling wood has kept improving throughout the twentieth century. By the 1960s, through the impact of the power saw and the diesel motor, formerly inaccessible timber stands were being logged at an accelerated rate. No valley escaped the scrutiny

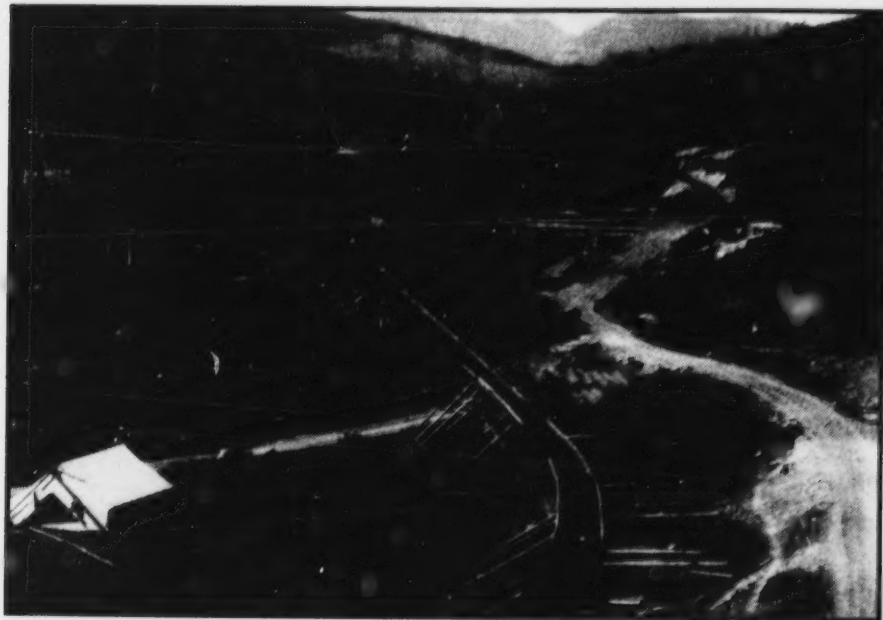


PLATE 2.8.1

In order to transport timber before the advent of modern machines this elaborate flume (the second largest in North America at the time) was constructed in the Moyie River Valley, photo circa 1922-30. (Photo credit: W. F. Montgomery, from B.C. Provincial Archives.)



PLATE 2.8.2

Early century logging was not concerned with its effect on other resources. These logs were floated down the Bull River from Galbraith Creek and will be floated to the mill at Wardner on the Kootenay River, photo circa 1922-30. (Photo credit: W. F. Montgomery, from the B.C. Provincial Archives.)

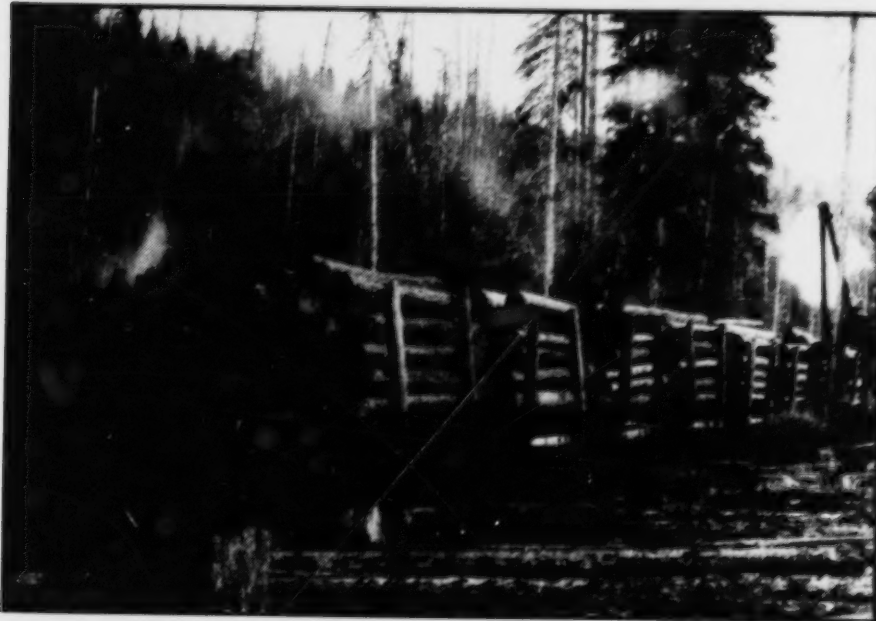


PLATE 2.8.3

Access to most timber was limited by the equipment used to haul it to the mills. Railroad logging was limited to the gentler terrain in the Rocky Mountain Trench and Elk Valley, photo circa 1922-30. (Photo credit: W. F. Montgomery, from B.C. Provincial Archives.)

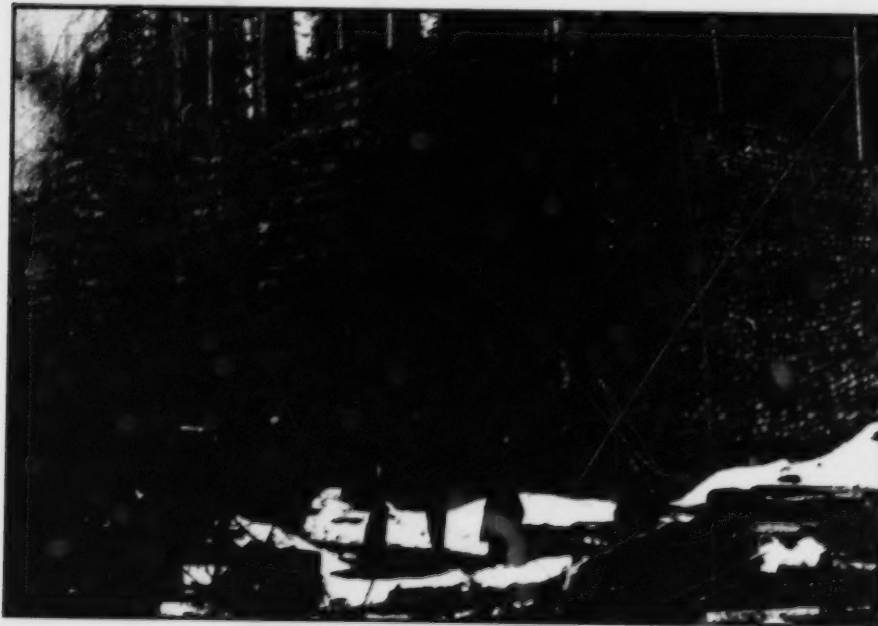


PLATE 2.8.4

When the railroads were built on the Prairies to haul grain, one source for the vast quantities of ties needed was the forests of the East Kootenay. This pile of ties represents 4,000 trees and the winter work for 60 tie-hackers, photo circa 1922-30. (Photo credit: W. F. Montgomery, from the B.C. Provincial Archives.)



PLATE 2.8.5

Logging in the earlier part of this century was limited by the type of transportation systems. Logging by the use of horses was restricted to the more accessible areas. (Photo credit: Spalding circa 1920, from B.C. Provincial Archives.)



PLATE 2.8.6

Modern machines have provided greater access to timber that was previously inaccessible. As a consequence, most of the roads built in the East Kootenay Region have been built in the last three decades.



PLATE 2.8.7

Immature Douglas-fir trees from the East Kootenay Region are valued as Christmas trees. The harvesting of these trees has not been able to keep up with forest encroachment on important ungulate winter ranges in the Trench and a more radical tree removal program is necessary to keep the seral-shrub ranges open.



PLATE 2.8.8

Clearcutting of the forest has been the normal plan in the East Kootenay. This clearcut is in the Palliser River Valley.

of the forest industry or the B.C. Forest Service and all major valleys, with few exceptions had logging haul roads or fire access roads (Phelps et al. 1983, Chambers 1974).

Early logging methods and practices had created another problem. While throughout history the forests, primarily the dry site forests, had burned at regular intervals, and were even burned by the Kootenay Indians, very little destruction had occurred (Gold 1913, Barrett 1980). In fact, fire kept many of the lower elevation stands open, and allowed the mature trees to dominate while the immature trees often perished and thus did not compete for light and moisture with the larger trees.

With the rapid expansion of the forest industry in the 1920s in response to a growing market for ties and lumber, large amounts of unusable wood and debris were left in the forests. This material fueled the fires of the late 1920s and early 1930s that burned the lower Elk Valley and the Trench from the international border to Dutch Creek (Andrews 1931, Hodging 1931, Demarchi 1971). Thus the productive Douglas-fir forests were eliminated from timber production for a considerable time. When Douglas-fir regeneration began to invade the logged and burned areas in the 1940s, the government developed a program to harvest Christmas trees. Farmers wishing to supplement their incomes could obtain a permit to cut young Douglas-fir. The underlying purpose was to thin the densely regenerating forests, while at the same time provide assistance to the agricul-

tural community (Churchill 1974). Land was also sold to farmers for the purpose of establishing permanent Christmas tree farms and several large American-based companies took advantage of the stumpage tax savings on Christmas trees harvested from private lands by amassing extensive private holdings, most of which still remain in fee simple ownership.

At the turn of the century, foresters were still looking for agricultural land to be settled (Gold 1913). And in the 1950s soil surveys of the East Kootenay District only "included all land of agricultural value" (Kelley and Sprout 1956, Kelley and Holland 1961) however, those two surveys did mention forestry values, when they occurred within their study boundaries.

2.9 LAND RESERVED FOR WILDLIFE AND RECREATION

It was the policy of the provincial government to use the sale of land and subsequent land taxes as a source of revenue (Cail 1974). Consequently, land was readily preempted and sold to settlers, mining companies and railroad companies, while Indians were placed on reserves and forestry, wildlife, recreation and wilderness values were given very little consideration for their land needs.

The first National Park in the B.C. portion of the Rockies was Yoho. In 1886, 2600 hectares were reserved. In 1919 Kootenay National Park was established, so that the federal government could justify monies being



PLATE 2.9.1

Wigwam Flats formed part of the Morrissey Game Reserve from the 1920's to the 1960's. The hunting of species of the deer family was prohibited here. This was one of the few attempts to legitimize the wildlife values in the Trench until the late 1960's; unfortunately this reserve concentrated on the management of harvests rather than emphasize the habitat aspects of wildlife management.



PLATE 2.9.2

Forest encroachment onto prime winter ranges is currently limiting the production of ungulates. An active burning program is necessary in order to maintain a desirable early seral stage of shrubs and grasses on the dry forest sites.

spent on building a road across the Rockies (Parks Canada 1979). In 1922 Mount Assiniboine Provincial Park was established, and in 1930, Yoho National Park was enlarged to 131,300 hectares. By 1930 only 409,700 hectares of major parklands were reserved in the B.C. portion of the Southern Rockies and Trench.

No parkland greater than 250 hectares was added to the system until 1959 when 259 hectares were reserved as Mount Fernie Provincial Park. Bugaboo Alpine Recreational Area and Bugaboo Glacier Provincial Park were established in 1969. In the 1970s six more provincial parks of over 250 hectares were added, and Mount Assiniboine Provincial Park was enlarged. The total land in park reserve status was increased by 496,044 hectares.

Of all this park reserve only Premier Lake Provincial Park and a very small portion of Kootenay National Park were located within the Rocky Mountain Trench. While parklands are supposed to be areas set aside for wilderness, wildlife and recreation, not one of the twelve larger parks in the East Kootenay region was designed to reserve land for an ecosystem or an ungulate population. Often park boundaries dissect critical ungulate summer or winter ranges.

In the 1920s two large tracts of land were established as game sanctuaries. The 33,161 hectare Morrisey Game Reserve was closed to the hunting of all members of the deer family and the 152,778 hectare Elk Valley Game Reserve was closed to all big game hunting. Both sanctuaries were

abandoned in the early 1960s because they were not meeting the objectives of current game management policy (R.A. Demarchi 1982, personal communication).

Some lands were set aside from further alienation for the purpose of providing wildlife habitat. In 1936 the White River Reserve, consisting of 266,386 ha, was established. This reserve is still in effect, although some lands have been alienated without the consultation of the B.C. Fish and Wildlife Branch (or any of its forerunners), and logging, road construction and mining exploration have occurred. Even though these were Order-in-Council reserves which legally consigned the land to the Game Commission (or Fish and Game Branch or Fish and Wildlife Branch) the prevailing philosophy of the times was that in order to manage "game" all that was necessary was to prohibit hunting, set land aside and prevent forest fires (Smith 1959).

In the 1970s the B.C. Fish and Wildlife Branch was given its first real opportunity to manage wildlife and its habitat when several ranch properties were bought out by the Crown. These lands were purchased in favour of wildlife management, the grazing permits associated with those ranches were retired, and the ranch lands were turned over to the Branch to be managed and manipulated for wildlife. Several other parcels of land were also either returned to the Crown or assigned to the Fish and Wildlife Branch in favour of wildlife management.

Currently there are approximate-

ly 36 parcels of land totalling over 340,000 hectares which are reserved against further land alienation for ungulate and waterfowl management purposes. There are also 14 parcels of land totalling more than 49,000 hectares which have been bought in fee simple or leased for ungulate and waterfowl management purposes (Dave Phelps and Bob Walker 1982, personal communication).

Beginning in the 1960s there was a change in the government attitude towards habitat-based wildlife management. Since that period lands were purchased for wildlife management in the Rocky Mountain Trench and on valuable ungulate winter ranges. However, the total area was low in comparison to the potential area needing management, as well as to lands removed from the habitat base for other, non-wildlife oriented uses.

2.10 USE OF THE WILDLIFE RESOURCES

The wildlife resources of the East Kootenay region have always been exploited by man. As noted in section 2.1 the first peoples in the region hunted big and small game for sustenance. The Early American explorers and fur traders likewise harvested big game for food and encouraged the native Indians to trap furbearers for their pelts.

It is interesting to note that except for David Thompson's journals for the period 1808-1811 (Hopwood 1971) there is scarcely any mention of wildlife or its use by travellers and residents. This is probably

because wildlife was so abundant and use so common that to mention wildlife in notes and journals was a statement the obvious. For example, scientific explorers such as Moberly, Dawson and Hector, who made meticulous comments bedrock geology, surficial geology and vegetation made few comments on the wildlife, but must have subsisted on game meat since they spent months travelling in remote areas.

Hunting is an important activity in the modern society of the mid-twentieth century. While it is doubtful that many families now require game meat in an absolute survival sense, many people depend on game meat as an animal protein source, and many more people use game meat to augment their animal protein intake. In addition there still exists a trapping industry, whereby furbearing animals are killed for their pelts by registered, licensed trappers. There is also an active big game guide-outfitter industry that caters primarily to the harvest of trophy game animals by a non-resident clientele.

In British Columbia, people wishing to trap crown land must either acquire a trapline from the Provincial Government which becomes the exclusive trapping domain of the registeree or they must obtain permission to trap from the registered trapline holder.

Only residents of the province can hunt big game without either a special permit or being accompanied by a registered big game guide-outfitter. Non-resident Canadians may hunt with a direct relative or



PLATE 2.10.1

The use of horses by guide-outfitters or resident hunters is a common means of gaining access to the mountains to hunt elk.



PLATE 2.10.2

Hunting is a legitimate use of the wildlife resource. During the period of 1976-80, the number of resident hunter days increased from 93,300 to 154,000 in the East Kootenay area.

with a big game guide-outfitter; and non-resident aliens must be accompanied by a guide-outfitter while hunting. Each guide-outfitter has a designated territory to which the hunting activities must be restricted; usually the territory is an exclusive guiding domain, but in some cases several guide-outfitters may share all or portions of a territory.

In the Elk-Flathead and Upper Kootenay strategic planning areas (for the B.C. Ministry of Environment), which includes all the study area except for the Columbia-Windermere valley and includes the St. Mary River watershed which is outside the study area, B.C. Fish and Wildlife Branch records show that during the period of 1976-1980 the number of resident hunter days increased from 93,300 to 154,000 (big game hunting only). There were approximately 9,000 to 15,000 hunters and each spent between 10 and 12 days per year hunting big game. The economic value of this activity as measured by the concept of willingness to pay increased from \$2,600,000 to \$4,300,000 (1980 dollar value) (Chris Gibbs personal communication, January 1984).

In 1977 there were 202 non-resident hunters in the Elk-Flathead and upper Kootenay strategic planning units. They hunted for 2,134 days and spent an average of \$2,130 per hunter for a total of \$430,000 (Quadra Economic Consultants Ltd. and Canadian Resources Consultants Ltd. 1979). These non-resident hunters were generally more successful than were the resident hunters. For example, in 1977 the non-resident

hunter shot one elk for every 25 days hunted, but the resident hunter only shot one elk for every 55 days hunted (Chris Gibbs personal communication, January 1984).

In 1980 a survey was conducted to determine the participation in outdoor recreation activities by residents of the Elk Valley and the cities of Cranbrook and Kimberley (Bailey and Nessman 1982). The level of recreational activity by people living in the Elk Valley and Cranbrook/Kimberley appears to be twice the national and provincial average for both types of use (Bailey 1984, personal communication). In 1980, 18% of Elk Valley and Cranbrook/Kimberley residents hunted, and residents in each area spent over 71,000 days pursuing that activity. In that year, 42% of the Elk Valley and Cranbrook/Kimberley residents made a special effort to enjoy non-hunting wildlife recreation, with almost half of the households involved making that effort at least once a week. The total number of recreational days spent by local residents in each of the study areas exceeded 250,000, and of those, more than 170,000 days were devoted exclusively to wildlife viewing. It should be noted that hunting is a sport dominated by young to middle-aged males (Pearse Bowden Economic Consultants Limited 1972). It would seem logical, therefore, to conclude that hunters spend more time and effort in pursuit of their activity; more so than do those engaged in fishing, beach visits, downhill skiing or camping.

Chapter 3



PLATE 3

The Fernie Basin from Leech Creek, September, 1944.
(Government of Canada Photo, T31L-183.)

CHAPTER 3 DESCRIPTION OF THE STUDY AREA

The study area is located in the southeast corner of the Province (Figure 3). It is bordered on the east by the Continental Divide (Alberta/B.C. border), on the south by the 49th parallel (or B.C./Montana border), on the west by 116° longitude and extends north to Ball Pass between Kootenay National Park and Banff National Park. The area covers the British Columbia portions of three 1:250 000 topographical maps; Fernie (82G) and Kananaskis Lake (82J) and Calgary (820). The major drainage systems are the Kootenay, Columbia, Elk and Flathead rivers. The tributaries of the Kootenay River include Simpson, Cross, Palliser, White, Lussier, Wildhorse, Moyie, Yahk, St. Mary's, Bull and Elk rivers. The Elk River's major tributaries are the Fording and the Wigwam rivers. The section of the Flathead River encompassed by the study area is the headwaters with the major extent of the Flathead being within Montana. The study area also encompasses the headwaters of the Columbia River in the area of Columbia and Windermere lakes with a short portion of flowing river between.

3.1 PHYSIOGRAPHIC REGIONS, LANDFORMS AND GLACIAL HISTORY¹

The East Kootenay study area contains parts of three major physiographic regions: the Rocky Mountains, the Rocky Mountain Trench and the Purcell Mountains (Holland 1964, see Figure 3.1).

3.1.1 ROCKY MOUNTAINS

The Rocky Mountains occupy the eastern two-thirds of the study area. These mountains consist of numerous elongate ranges aligned approximately from north-northwest to south-southeast, and vary in elevation from 750 to 1,850 m with summit elevations between 2,000 - 3,600 m. The Rocky Mountains can be further subdivided into the Continental Ranges (Park, Kootenay and Front Ranges) and the Border Ranges. The Fernie Basin is found within the Continental Ranges and is noteworthy for its relatively subdued topography (450 - 750 m range of relief with rounded summits of 1,400 to 2,200 m).

Within southern British Columbia and Alberta, the Rockies consist predominantly of sedimentary rocks. Deformation and uplift of these sediments took place during Cretaceous and early Tertiary time (Laramide Orogeny). The mass of sediments was thrust eastward over younger strata lying along the western margin of the Great Plains. Shearing and contortion during deformation gave rise to the north-northwest south-southeast trending faults and folds that control the present day linear topography. The character of terrain within the Rocky Mountains is variable, due to differences in structural style and rock types.

These ranges are bordered by the Rocky Mountain Trench on the west and by the Rocky Mountain foothills to the east and are an area of rugged mountainous topography with high relief. Mountain peaks in the vicinity of 3,600 m elevation occur along the Continental Divide, while peaks

¹This section was written by Larry Lacelle, Pedologist, Ministry of Environment, Kelowna, B.C. and June Ryder, Surficial Geologist, Ministry of Environment, Victoria, B.C.

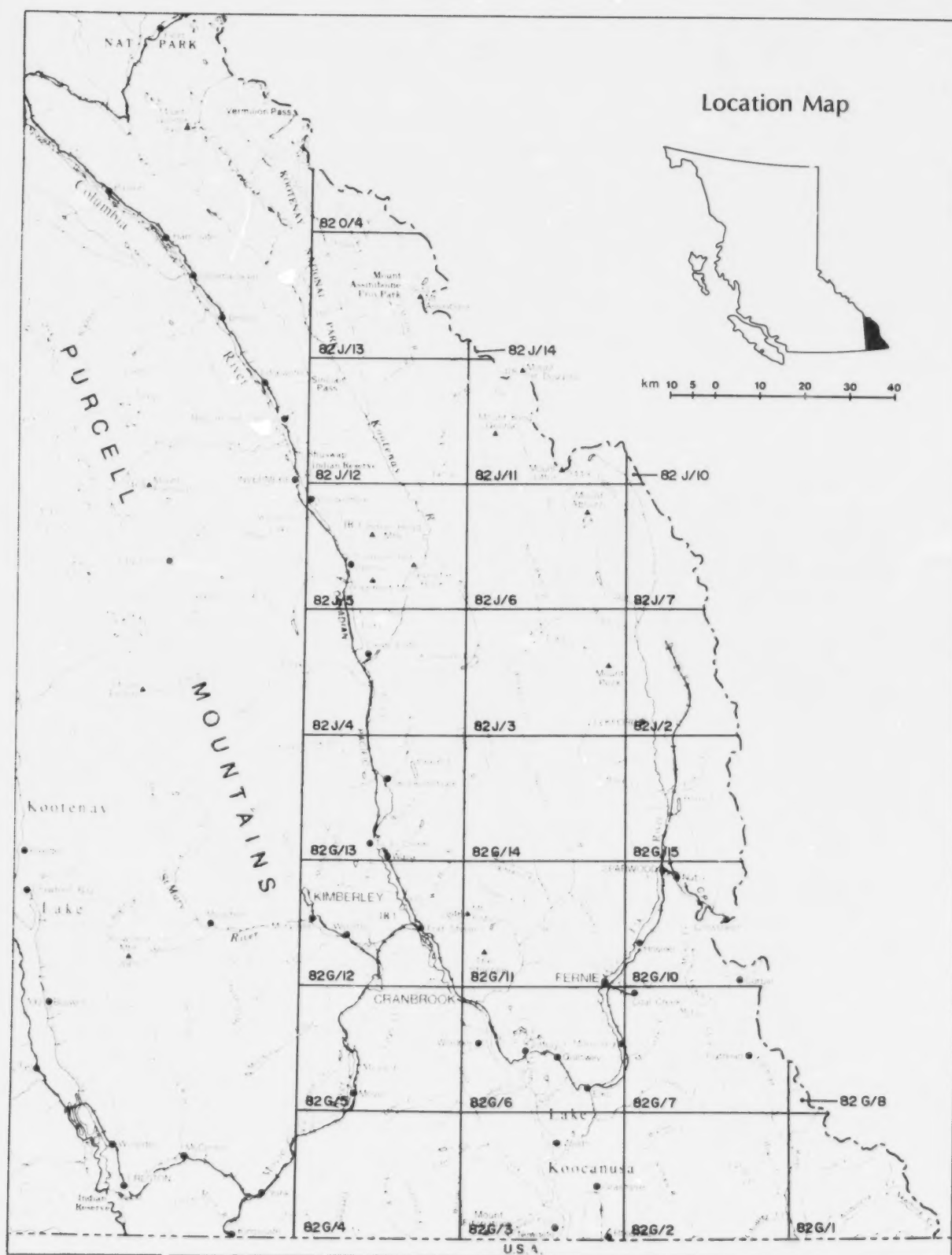


FIGURE 3 Location Map (with 1:50 000 Grid).

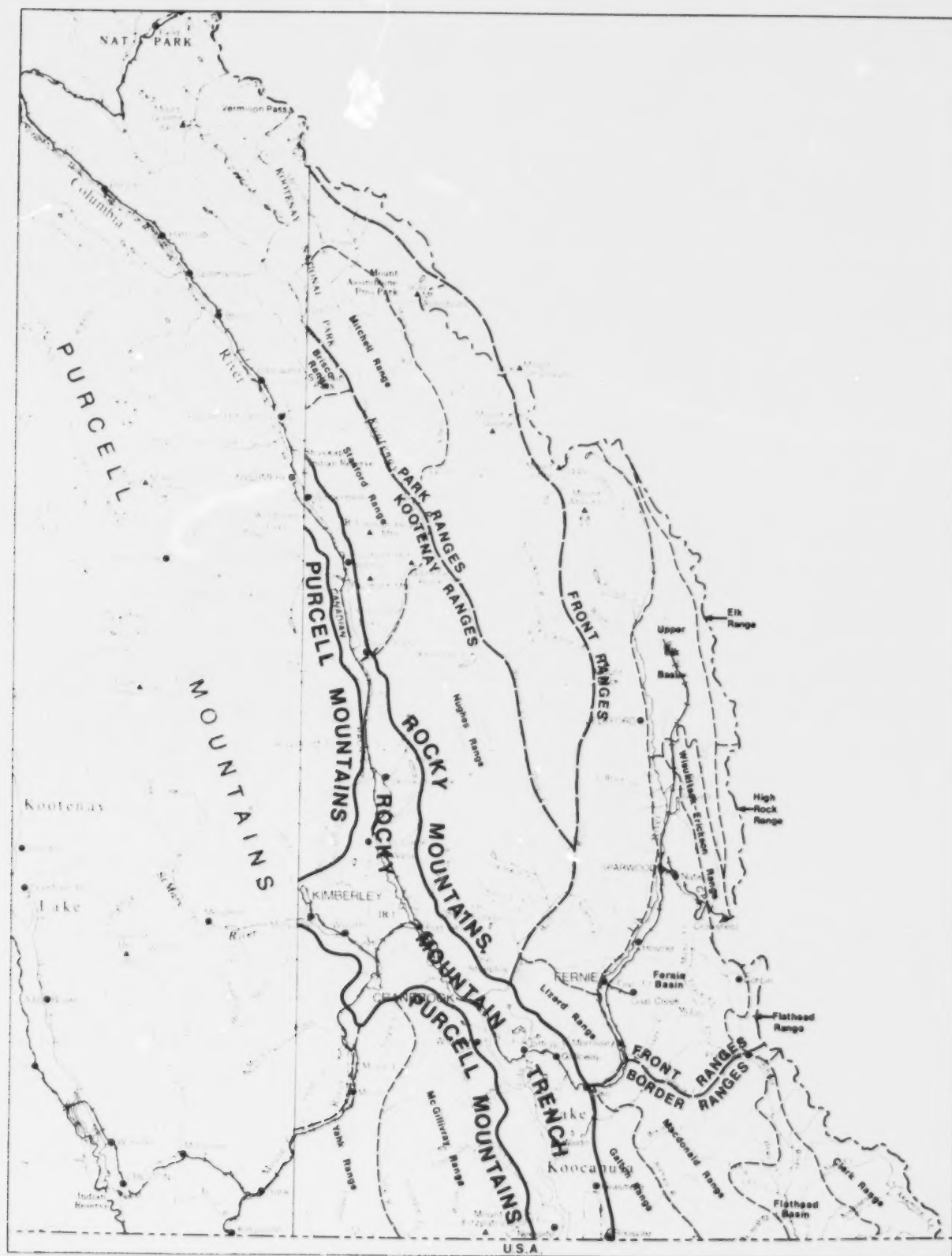


FIGURE 3.1 Physiographic Regions. (After Holland 1964 and Dick 1978.)

of 2,600 m elevation are common elsewhere. The mountain ranges trend northwesterly, as do most of the intermontane valleys. Mountain peaks have been extensively sculptured by alpine glacial processes, while the valleys have been deepened and widened by valley glaciation into typical broad floored, U-shaped forms. These valleys have been partially infilled by varying depths of glacial drift. Since calcareous bedrocks (limestone, dolomite) are dominant in the Rockies, most of the drift is calcareous also. Extensive areas of non-calcareous siltstones, sandstones, schists and quartzites do occur, however, and the drift in these areas is commonly either only weakly calcareous or non-calcareous.

Mountain summit areas are most commonly very steeply sloping bare rock with localized accumulations of blocky and rubbly scree and talus. High elevation areas with more subdued topography are commonly covered by rubbly colluvium or rubbly moraine (till). Mountain midslopes are most commonly veneered or blanketed by rubbly colluvial or morainal deposits, or are exposed bedrock. Lower slopes consist of deep, rubbly and blocky colluvial blankets, aprons or fans, commonly interspersed with morainal or gravelly glaciofluvial deposits. Valley floors are commonly composed of hilly to rolling morainal materials interfingering by gravelly glaciofluvial deposits. Large glaciofluvial fans and terraces are common on the lower slopes of many valleys and areas of silty or clayey, often eroded, glaciolacustrine deposits occur locally as well. Organic deposits are very

limited in occurrence; extensive deposits are present only in the upper reaches of some valleys.

Most water courses are swift flowing and downcut into glacial drift. As a consequence, their floodplains are commonly confined and gravelly or sandy in texture. Some aggrading water courses occur near ice fields and are characterized by braided channels and coarse textured sediment. Large fluvial fans are sometimes common on the floodplains, as well as on older, large glaciofluvial fans and terraces, especially where tributary streams enter larger valleys.

Fluvial, glaciofluvial, morainal and glaciolacustrine surficial materials are all often veneered by sandy or silty eolian (windblown) deposits.

3.1.2 ROCKY MOUNTAIN TRENCH

The Rocky Mountain Trench is an 8 to 25 km wide, structurally controlled valley that has been considerably modified by erosion, and, during Pleistocene glaciations, infilled to varying depths with glacial drift. Since deglaciation, the Kootenay and Columbia rivers have incised themselves into the drift. The drainage divide between these major river systems in the Trench is very low and stream gradients gentle. On the Columbia, in particular, this has resulted in development of a wide floodplain of silty and fine sandy sediments. The Trench is highest in elevation at its southern end (790 m). It remains at approximately 760 m for most of its length in the study area. Surficial materials in

the Trench are most commonly calcareous, due to the dominance of calcareous bedrocks in the Rockies from which much of the materials was derived.

The steep, western front of the Rockies is a major fault scarp which rises about 1500 m above the Trench floor. Rock outcrops on the Trench floor are the exposed parts of ridges that separate deep structural basins. In general, the bedrock surface rises gradually westwards into the hilly terrain of the eastern Purcell Mountains. The Trench commonly consists of extensive areas of hilly moraine (till). Interspersed between the hills are gravelly glaciofluvial meltwater channel deposits, terraces and fans. Remnants of silty and clayey textured glaciolacustrine terraces, often eroded, exist where late Pleistocene glacial lakes developed between valley glaciers and the valley walls. Rivers commonly meander across silty or sandy floodplains within the limits of their incised valleys. Fluvial fans of varying textures and sizes commonly cover portions of the surfaces of these floodplains, as well as the surfaces of higher, adjacent fluvial and glaciofluvial terraces and fans. In the study area the surficial materials are commonly veneered by fine sandy windblown deposits. The steep mountain slopes bordering the Trench are most commonly veneered or blanketed by rubbly colluvium. Morainal (glacial till) and gravelly glaciofluvial deposits are common on these slopes also, especially at lower elevations.

3.1.3 PURCELL MOUNTAINS

Within the study area, the Purcell Mountains are underlain by metamorphic and sedimentary rocks. Although similar rocks form bold and steep terrain along the crest of the Purcell Mountains, topography in the Yahk and McGillivray Ranges is relatively subdued. This is possibly the result of the relatively less tectonic uplift of this area as compared to the high Purcells and the Rockies; or the overriding of most of this area by ice during Fraser glaciations. Alpine glacial landforms (shallow cirques) are limited to the few summits that rise above 2000 m. However, summits and ridge crests are typically rounded or gently undulating, summits are low, range of relief is small, and valley sides have low gradients, particularly in the Yahk Range.

Most upland areas are mantled by at least a thin covering of drift. Extensive drift-covered areas occur in the Yahk Range and in the northern part of the McGillivray Range. Bedrock outcrops and colluvial slopes are restricted to steep terrain, convex breaks of slope, and some ridge crests. Bedrock and colluvium are widespread only in steep terrain around Moyie Lake and Moyie River valley (atypical for the Purcells), and in high land at the southern end of the McGillivray Range between Yahk River and upper Bloom Creek.

There are narrow belts of flat land along most valley floors. Creeks of moderate size such as Bloom, Teepee, and Gold River flow on narrow, poorly drained floodplains.

Along the eastern margin of the Purcell Mountains adjacent to the Rocky Mountain Trench, some of the larger water courses are deeply incised.

The lower eastern slopes of the Purcell Mountains are traversed by many glacial meltwater channels and adjacent spreads of fluvioglacial gravels are common. They are steep-sided, flat-floored, sinuous ravines which range in depth from a few metres to over 300 m. Some channels have no through flowing drainage at the present time, others contain small meandering creeks, lakes, and pockets of organic terrain and a few meltwater channels remained permanently occupied by rivers, such as Moyie River.

3.1.4 GLACIAL AND POST-GLACIAL HISTORY

The present landforms and surficial materials of the East Kootenay region date from glaciations of the latter part of the Pleistocene Period and recent post-glacial time. In fact, most surface features are no older than the final Fraser Glaciation which commenced about 20,000 years ago. At this time, ice accumulated and flowed outwards from the high parts of the Purcells and Rockies to form a vast southerly flowing glacier in the Rocky Mountain Trench. All land below about 2250 m was overridden by ice and rounded ridge crests and summits were formed by ice abrasion. Higher peaks were sculptured into horns and knife-edged ridges by cirque development at glacier heads. A covering of glacial till was plastered along valley sides

and other gently sloping surfaces.

Ice melting and recession commenced roughly 14,000 years ago. As the glacier in the Trench thinned, meltwater flowed along the ice margins and formed deep channels such as those presently occupied by Lost Dog Creek, the Moyie River on its gorge and the gorge of the Elk River below Elko. Glaciers receded from the lower portions of some tributary valleys while an ice tongue remained in the trench. This blocked drainage, and lakes existed in valleys such as the St. Mary, Elk and Findlay. Glaciolacustrine silts deposited in those lakes were exposed along modern terraces, scarps and road cuts. Streamlined hills of till (drumlins) were formed beneath actively flowing (but retreating) ice on the Trench floor. As they emerged from beneath the receding glacier snout they were partially eroded by meltwater and surrounded or partially buried by outwash gravels.

As the Trench glacier receded northward beyond Canal Flats, southerly drainage from the ice front was impeded by recently formed outwash terraces. This resulted in the formation of glacial "Lake Invermere" - the forerunner of Columbia and Windermere Lakes. Thick glaciolacustrine silts deposited in this lake now form prominent bluffs around the modern lakes.

Lakes were also ponded in mountain valleys during ice recession, as indicated by the glaciolacustrine silts and sands and a few gravel deltas in valleys such as Wigwam, Flathead, Elk, Bull, Gold, White,

Lussier and Dutch. These lakes drained as the ice disappeared.

Winnowing by wind was effective on the newly exposed and non-vegetated surfaces of these lacustrine and outwash sediments. Silt and fine sand particles were transported and redeposited to form cappings of fine textured materials on higher terraces and till areas. This process has continued in a minor way until the present day. Dunes have formed in several places near the channel of the Kootenay River and along the edges of benches overlooking Columbia and Windermere Lakes.

In the post-glacial period, rivers and creeks have cut down through drift and bedrock to form terraces along most valley floors. Modern floodplains are present, but are narrow and discontinuous along all but the largest rivers such as the Kootenay and Elk. Alluvial fans have been formed where tributary creeks debouch onto terraces and floodplains.

On mountainsides, weathered rock debris has accumulated either as distinctive landforms such as talus cones or as a widespread mantle of variable thickness. Debris dislodged by snow avalanches has also accumulated at the base of mountain slopes.

In alpine areas a mantle of frost-shattered rubble covers most moderate to gentle sloping surfaces and is slowly creeping downslope due to solifluction. Small moraine ridges have been formed in front of most modern glaciers.

3.2 CLIMATE¹

3.2.1 MACROCLIMATIC PROCESSES

The climate of the East Kootenay study area is an expression of the interaction between weather systems, solar radiation and the regional topography. Air flow over the area is generally west to east due to the presence of the prevailing westerly winds. The region is most frequently influenced by maritime polar air masses which have been considerably dried while being lifted over the Coast, Monashee and Selkirk mountains.

During the summer, large high pressure systems passing over the north central United States occasionally pump warm dry air into the region from the south and southeast. During the winter months, outbreaks of Arctic air surge from the north along the Rocky Mountain Trench, bringing with it very cold conditions and deep valley inversions. Under these conditions, mid-elevation sites along the lower Kootenay and Columbia River valleys can be considerably warmer than sites at lower elevations. Arctic air may spill into the upper Elk River valley, and perhaps the Flathead River valley, through the lower passes of the Rocky Mountains.

During the late-spring to early-fall period, cold, low-pressure cells situated over the northwestern United States and east of the Rocky Mountains, force cool, relatively moist air up the eastern slopes of the Rocky Mountains. This condition

¹This section was written by R.D. Marsh, Climatologist, Air Studies Section, Ministry of Environment, Victoria, British Columbia.

can lead to orographically induced extreme rainfall events near the headwaters of tributaries to the Elk and Flathead Rivers.

The Columbia, Kootenay, Elk, and Flathead Rivers and intervening topography are oriented perpendicular to the prevailing westerly winds. As a result, regional temperature and precipitation patterns reflect the rising, sinking, and drying of the maritime polar air mass as it traverses successive mountain ranges of the region.

3.2.2 PRECIPITATION PATTERNS

Precipitation generally increases south to north, east to west and with increasing elevation. In the Rocky Mountain Trench, precipitation is lowest near to Invermere and increases towards Cranbrook but decreases again towards the Tobacco Plains area. The greatest precipitation occurs at mid to upper elevations along the west facing slopes of the Purcell Mountains. Reduced amounts occur at similar elevations along the

west facing slopes of the Rocky Mountains. As the air crosses the first range of the Rocky Mountains, less moisture remains to be precipitated so there is a gradual drying trend to the east.

Valley bottom precipitation is lowest in the Rocky Mountain Trench, and second lowest in the Elk River valley from a point south of Sparwood to Line Creek, and in the Upper Kootenay River valley south from Kootenay Crossing. These are rainshadow areas situated east of the Purcell Mount-

ains, and Front and Kootenay Ranges of the Rocky Mountains respectively. The Crowsnest Pass, Elko and Forsyth Creek area of the Elk valley, and the Kootenay River valley south from Kootenay Crossing, receive comparable amounts of precipitation. The lower Flathead valley receives a similar amount but being at a higher elevation is relatively drier than these other areas. A precipitation maximum occurs in the Morrisey area which reflects the lifting of the Pacific air masses over the west facing slopes of the Front Range. A similar but less pronounced effect occurs elsewhere along the west facing slopes of the Rocky Mountains as demonstrated by a 50% increase in precipitation from the west gate of Kootenay National Park to a low elevation site 7 km to the east. From this latter site to Kootenay Crossing, precipitation drops 8%. Precipitation is believed to increase north of Kootenay Crossing. Precipitation generally increases with an increase in elevation, but because the maximum precipitation occurs at the base of the clouds, the subalpine forests receive more moisture than do the higher krummholz and alpine areas. On the mountain tops and ridges the strong winds also combine with the rugged topography to produce some precipitation shadows.

3.2.3 SNOWFALL AND SNOW DENSITY

The depth and density of snow on the ground varies considerably over the East Kootenay region. Although there are three distinct 'snow zones' in the area, the general distribution of snow increases in depth south to north, east to west, and with

increasing elevation.

Snow depth is highly variable since it is dependent on the geographic location and physical orientation and exposure of the landscape. Warm, windy, and/or sunny sites encourage reduced snow depths by melting, compaction, and evaporation while at the same time increasing snow densities. Conversely, cool, sheltered, and/or shady sites encourage deeper snowpacks of lower density. Local snow depth is greatly reduced on exposed, moderately inclined south and southwest facing slopes. This is true along most of the valleys where topographic shading is not excessive and is particularly true at low elevations along the Rocky Mountain Trench, and Kootenay and lower Elk River valleys where higher day-time maximum temperatures contribute to the reduction of snow-cover.

The typical distribution of snow from month to month and with elevation, is similar for most of this part of the East Kootenay Region. Two areas which are notable exceptions are (1) the lower Elk River valley just east of the Rocky Mountain Trench, and (2) the area extending the length of the Kootenay River valley east of the Trench, along the lower White River valley, to the headwaters of Blackfoot Creek.

In all areas, but the two exceptions mentioned above, the average maximum snow depth reaches 35 cm by early March at an elevation of 1000 metres. At 1500 m this increases to 80 cm by mid-March and at 2500 m increases to 215 cm by late April.

Mean maximum valley bottom snow depths are typified by 20 cm in January at Cranbrook, 66 cm in the Elk Valley north of Sparwood, and 70-80 cm by late February to early March in the lower Flathead River valley. Snow depths on the east facing slopes of the Purcell Mountain are similar to those at comparable elevations in the rest of the Rocky Mountain Trench and upper Elk River valley.

A zone of considerably reduced snow depth exists east of the Trench, along the Kootenay and lower White River valleys, and possibly extending as far south as the headwaters of Blackfoot Creek, northeast of Top of the World Park. In this zone, snow depths are 120 to 140 cm less than those at comparable elevations in the Morrissey area and 50 cm less than comparable elevations in other areas. Maximum snow depths occur at times which are consistent with the rest of the East Kootenay region although the end of the snow season is likely to occur two to three weeks earlier than similar elevations in other areas.

A relatively high snowfall zone exists in the Morrissey-Fernie area. This corresponds to the area of high precipitation caused by the lifting of semi-dried Pacific air over the west facing slopes of the Rocky Mountain Trench. At an elevation of 1000 metres, average maximum snow depths of 65 cm are reached in February or March - the snow season lasting from November to late April or early May. At 1500 m the average maximum of 145 cm is reached in early March and the snow season extending to early June at 2500 m. Average maximum snow depths of 320 cm occur

by late March to early April; at this elevation snow on the ground lasts until mid-June. Valley bottom snow depths are typified by those at Fernie where average maximums of just under 65 cm are realized in late February. Here snow depths are 11% greater than valley bottom sites in the central Elk River valley.

To a large degree, snow density is influenced by local site exposure and climatological conditions. However, in any particular month, densities tend to increase with increasing elevation. In January, densities at 2500 m are about 45% greater than those at 1000 m. This difference is reduced as the season progresses. By May, the difference in snow density between these two elevations is reduced to 11% for most of the region, and to 25% for the Morrissey area.

Snow density increases at all sites as the snow season progresses. As a very general rule-of-thumb this increase, after January, averages 0.036 gm/cc/month for most of the region; 0.05 gm/cc/month in the Morrissey area, and 0.025 gm/cc/month in the upper Kootenay valley. January snow densities in all areas are comparable at comparable elevations.

The snow regime of the Bull River valley has not been described due to the non-existence of a climatological data base. It is expected that a small extent of the lower Bull valley, just east of the Trench, (from the Aberfeldie Dam to about Van Creek) will exhibit snowpack characteristics similar to those of the Morrissey area. Upstream of the confluence of the Bull River with Van

Creek, the more typical regional characteristics are likely to apply.

3.2.4 TEMPERATURE AND EVAPOTRANSPIRATION

Regional temperatures generally decrease west to east, with increasing elevation, and with increasing latitude. Summer and winter temperature distributions are similar although some areas have lower minimums due to cold air pooling during the summer and other areas have suppressed maximums and minimums where they are influenced by Arctic air during the winter and early spring. The greatest diurnal temperature range exists in the upper Kootenay River valley followed by the Flathead valley, Rocky Mountain Trench and the Elk valley between Sparwood and Forsyth Creek. Diurnal temperature ranges are greatest in rainshadow areas where reduced moisture leads to higher surface temperatures and where clearer skies lead to night time radiational cooling and cold air pooling. Diurnal temperature range decreases with increasing elevation, since atmospheric mixing increases with increasing elevation and as the effects of cold air pooling and inversions are avoided; except in the alpine and krummholz areas where there is a reduced capacity of the atmosphere to store heat and thus to moderate surface temperature extremes. As a consequence, the surface temperature of the mountain tops and ridges has a wide diurnal range.

The warmest regional temperatures occur at low elevations in the Rocky Mountain Trench. The width of

the Trench encourages increased surface heating by reducing the effects of topographic shading. Intense surface heating by solar radiation leads to convective currents up the valley slopes and subsiding air over the centre of the valley during the daylight hours in the summer. This, in turn, discourages the build-up of clouds over the valley and increases the opportunity for surface heating by solar radiation. This happens to a lesser degree in the upper Kootenay River valley. A similar mechanism occurs in the central Elk valley and the lower Flathead valley but the effects are mitigated to some extent by increased topographic shading in the former valley and a higher elevation in the latter.

The highest minimum temperatures occur at low elevation sites along the west facing slopes of the Rocky Mountains where tributary valleys empty into the Trench. Examples are Elko and Kootenay National Park west gate where night-time outflow from the tributary valleys helps mix the cool surface air with the warmer layers above. Minimums increase with increasing elevation for an estimated 100 metres above the valley bottom because of inversions and then decrease with increasing elevation above this height. Minimums decrease northward in the Elk valley due to decreasing day-time temperatures and the occurrence of night-time pooling of cold air in the valley. The coolest temperatures in the Elk valley occur north of Sparwood because of: reduced night-time mixing of surface air; and the elevation and reduced width of the valley. Arctic air may seep into the upper portions

of the valley during the winter while the lower reaches remain in milder Pacific air. The upper Kootenay and lower Flathead valleys have minimums comparable to the upper Elk valley. Here minimums are enhanced by the broad, sheltered valleys and by the cool, dry mountain ranges to the north and east which serve as a source of cool night-time downslope winds.

Winter temperature inversions are common to all valleys and may reach depths estimated to be 400-500 metres with Arctic outbreaks. Shallower inversions occur during clear nights in most low lying areas.

Potential evapotranspiration (PET) rates increase with increasing temperature and increasing solar radiation. Hence, the greatest PET rates are at low elevations along the Columbia River and lower Kootenay valleys, followed by the Sparwood area and the Flathead valley. Day-time temperatures and PET rates are considerably increased with increasing inclination on south and southwest facing slopes. These sites can have snow depths considerably reduced from those on other slopes and aspects at the same elevation. Often snow depths are less than on poorly oriented sites at lower elevations.

Where high PET rates and low precipitation occur at the same site, climatic moisture deficits, and usually soil moisture deficits, are usually large. This is particularly true of the low elevation, and steeply inclined south to southwest facing, mid-elevation sites within the

Rocky Mountain Trench. This is true also for the upper Kootenay River, Sparwood and lower Flathead areas, although to a considerable lesser extent due to lower temperatures and increased rainfall.

The upper Flathead valley is climatically similar to the upper Elk valley although it is narrower and is influenced less frequently by Arctic air outbreaks. Here precipitation is a function of elevation and amounts similar to those at Morrissey are received. Only the southern parts of this valley are in a local rain-shadow.

No climatic data are available for the Kootenay River valley north of Kootenay Crossing. It is believed that a gradual increase in precipitation, and decrease in both maximum and minimum temperatures will occur north of Kootenay Crossing. Arctic air probably moves into the upper Kootenay valley from the north via the Kickinghorse and Beaverfoot Rivers. This is likely a common occurrence and may be reflected by the January mean minimum temperature at Kootenay Crossing (-18.1°C).

3.3 FOREST ZONATION¹

Forest Zonation delineates areas of land based on the influence of climate and on the occurrence and distribution of vegetation. To reflect climate, four levels of zonation: Forest Region, Forest Section, Forest Zone and Forest Subzone are used to describe successively more refined levels of climate. Within the East Kootenay area, two Forest

Regions occur, the Dry Interior region and the Interior wet belt region (see Figure 3.3).

3.3.1 DRY INTERIOR REGION

The Dry Interior region is found throughout most of the East Kootenay study area. This region is an area of relatively low precipitation and high summer temperatures. Forests tend to be open in areas of extreme moisture deficits such as low elevation areas and south to west facing slopes. Because of the frequency of forest fires and disturbance by man, most of the forests in this region occur presently in seral stages. The forests are usually composed of ponderosa pine², lodgepole pine, western larch and Douglas-fir³ at lower elevations and lodgepole pine, white-bark pine, alpine fir and Englemann spruce at higher elevations. This region is composed of two forest Sections, the Cranbrook Section and the Radium Section.

The Cranbrook section occurs in the Rocky Mountain Trench south of Columbia Lake. This area is the driest part of the study area. The vegetation occurs in a mosaic of open to parkland forests mixed with savanna communities, particularly below 1400 m elevation. Above this, closed and open forests dominate the mountain slopes. Low elevation forests are usually composed of ponderosa pine, lodgepole pine, western larch and Douglas-fir. Higher elevation forests are usually composed of lodgepole pine, Engelmann spruce and alpine fir.

¹This section was written by E.C. Lea, botanist, Surveys and Resource Mapping Branch, Ministry of Environment, Kelowna, B.C.

²Plant names follow Taylor and MacBryde 1977.

³The name Douglas-fir will be used throughout this report instead of Rocky Mountain Douglas-fir as recommended by Taylor and MacBryde (1977) except in the naming of forest zones and subzones.

The Radium section occurs within the Rocky Mountains as well as in the Rocky Mountain Trench, north of Columbia Lake. This area is climatically cooler and receives more precipitation than the Cranbrook section. The Radium section generally has more closed forests and better tree growth than the Cranbrook section. At high elevations (above 2000 m) a mosaic of open forests, meadows, tundra, krummholz and rocky areas occurs in high mountain slopes, ridges and cirques. Low elevation forests are usually composed of lodgepole pine, western larch and Douglas-fir. High elevation forests are usually composed of lodgepole pine, whitebark pine, alpine fir, Engelmann spruce and alpine larch; these species predominate due to the limited occurrence of climax stands in the study area.

Three forest zones are found in both the Cranbrook section and the Radium section. These are the Interior Rocky Mountain Douglas-fir zone, the Subalpine Engelmann spruce-alpine fir zone and the Alpine tundra zone.

3.3.1.1 The Interior Rocky Mountain Douglas-fir Zone

This zone is found at low elevations throughout the Dry Interior region. Composition of forest stands varies by subzone and includes ponderosa pine, lodgepole pine, western larch and Douglas-fir. In wetter areas of valley bottoms, vegetation is dominated by willows, black cottonwood, trembling aspen and white spruce. Wetland areas are dominated by sedges, cattails and rushes. This zone has three subzones: the ponderosa pine subzone; the western larch-ponderosa pine subzone; and the lodgepole pine subzone. All three are present in the Cranbrook section while only the lodgepole pine subzone is found in the Radium section.

rosa pine subzone; the western larch-ponderosa pine subzone; and the lodgepole pine subzone. All three are present in the Cranbrook section while only the lodgepole pine subzone is found in the Radium section.

3.3.1.2 Subalpine Engelmann Spruce - Alpine Fir Zone

The Subalpine Engelmann spruce-alpine fir zone is subject to higher precipitation, lower temperatures and a shorter growing season than the Interior Rocky Mountain Douglas-fir zone. The subalpine zone is found at higher elevations on mountain slopes of the study area. Composition of forest stands varies by subzone and includes lodgepole pine, Douglas-fir, western larch, whitebark pine, alpine fir, Engelmann spruce and alpine larch. Edaphic, rough fescue grasslands, that resemble alpine tundra occur on rounded summits in the High Rock Range. In wetter areas of valley bottoms, vegetation is dominated by willows, black cottonwood and Engelmann spruce. Wetland areas are dominated by willows and sedges. This zone has three subzones, the Rocky Mountain Douglas-fir - lodgepole pine subzone, the Lodgepole pine - whitebark pine subzone and the Krummholz subzone. All subzones are found in both the subzones are found in both the Cranbrook and Radium sections.

3.3.1.3 Alpine Tundra Zone

The Alpine tundra zone has a severe climate that prevents the establishment of tree species. Much of the area within this zone consists of steep rocky slopes. Vegetation is

Biophysical Resources of the East Kootenay Area: Vegetation Regions, Zones and Subzones



usually present where a veneer of soil occurs. Vegetation present may consist of willows, white mountain-avens, alpine bluegrass, mountain-heather, moss campion, lichens and grasses.

3.3.2 INTERIOR WET BELT REGION

The Interior wet belt region is mainly found in the southwestern corner of the study area, south and west of Moyie Lake. Scattered occurrences of this region are present in the Rocky Mountains in Sand Creek, Bull River, Lodgepole Creek, Little Van Creek and south of Fernie. This region is an area of relatively high precipitation and relatively mild winters which result in closed to dense forests and good tree growth. Forest stands are more commonly dominated by climax species as fires are not as common as within the Dry Interior region. The forests are usually composed of Douglas-fir, western white pine, western hemlock and western red cedar at lower elevations and lodgepole pine, alpine fir and Engelmann spruce at higher elevations. Three Forest Zones are found in the Interior wet belt region, the Interior western hemlock - western red cedar zone; the Interior western red cedar zone and the Subalpine Engelmann spruce-alpine fir zone.

3.3.2.1 Interior Western Hemlock - Western Red Cedar Zone

The Interior hemlock-western red cedar zone is found at low elevations in the Moyie Lake area. The vegetation varies by subzone. In the lower Rocky Mountain Douglas-fir - lodgepole pine-western larch subzone, stands are composed of lodgepole

pine, western white pine, western larch and western hemlock. The understory is dominated in the shrub layer by Oregon boxwood, western thimbleberry and birch-leaved spirea. The herb layer commonly consists of blue-bead clintonia, unifoliate-leaved foamflower and northern twinflower. The moss layer is usually well developed.

3.3.2.2 Interior Western Red Cedar Zone

The Interior western cedar zone is only found south of Fernie. The vegetation varies by subzone. In the lower Rocky Mountain Douglas-fir subzone, stands are composed of Rocky Mountain Douglas-fir, western larch and western red cedar. The shrub layer is dominated by Oregon boxwood, western yew and western thimbleberry. The herb layer is dominated by blue-bead clintonia, oak fern, northern twinflower and heart-leaved arnica. Forest stands dominated by western red cedar may be very dense and have a sparsely vegetated understory.

3.3.2.3 Subalpine Engelmann Spruce - Alpine Fir Zone

The Subalpine Engelmann spruce-alpine fir zone found in this region is similar to that of the Dry Interior region. Only one subzone, the forested subzone, is recognized for the study area. The forests are generally closed and composed of lodgepole pine, western larch, Douglas-fir, alpine fir and Engelmann spruce. The shrub layer is dominated by smooth Pacific menziesi, black blueberry and white-flowered rhododendron. The herb layer consists of grouseberry, bluebead clintonia and heart-leaved

arnica. The moss layer is usually well developed and dominated by common moss, layered moss and feather moss.

3.4 SOILS¹

The soils of the East Kootenay Study Area can be placed into three broad groupings based on the three major physiographic regions.

3.4.1 SOILS OF THE ROCKY MOUNTAIN TRENCH

The broad floor of the Rocky Mountain Trench is primarily characterized by Orthic Eutric Brunisolic soil developments weathered from fluvioglacial, fluvial, morainal or colluvial surficial materials. On coarse textured fluvioglacial and fluvial gravels and sands, these soils are very droughty in the summer and consequently can support only open canopied stands of Douglas-fir and ponderosa pine with relatively dense herb and shrub understories. The edaphically driest areas of gravels as well as west and south aspects subject to excessive solar insolation, are characterized by grasslands with Orthic Dark Brown Chernozemic soil developments. In such areas, trees are scarce, being limited to gullies and swales while shrub, herb and grass species dominate the flora. Morainal surficial materials in the floor of the Rocky Mountain Trench with silt loam or finer soil textures may be characterized by Orthic Gray Luvisolic or Brunisolic Gray euvisolic soil developments and may have superior soil nutrient status and soil water re-

tention capacities in comparison to the previously described coarser textured soils. Consequently, areas of finer textured soils may be characterized by vegetation typical of moister soil moisture regimes. Steep slopes in the Rocky Mountain Trench are commonly characterized by youthful Orthic Eutric Brunisol or Orthic Regosol soil developments weathered from deep or shallow deposits of rubbly colluvial materials. Such materials may be characterized by excessive summer droughtiness, and consequently forest cover may be sparse with shrub, herb and grass species being relatively abundant. Floodplains on the floor of the Rocky Mountain Trench are commonly silt loam textured, imperfectly to poorly drained and characterized by Gleyed Cumulic Regosolic and Rego Gleysolic soil developments. Vegetation patterns on the floodplains are complex due to localized variation in soil drainage.

3.4.2 SOILS OF THE ROCKY MOUNTAINS

At lower elevations and in the major valleys of the Rockies, soils are often similar to those of the Rocky Mountain Trench. Brunisolic soils are commonly underlain by carbonate enriched (calcareous) layers within 20 to 50 cm of the surface. They are most common on relatively coarse textured soil parent materials. The less common luvisolic soils with gray, leached upper mineral soil layers and clay enriched subsoils, are more prevalent on finer textured soil parent materials. The luvisols also are most commonly calcareous bedrocks, where soil developments are deeper. In

¹This section was written by L. Lacelle, Pedologist, Surveys and Resource Mapping Branch, Ministry of Environment, Kelowna, B.C.

these latter areas, both the brunisolic and luvisolic soils are commonly moderately acidic, with brownish upper mineral soil layers. Forest floors at these lower elevations are generally thin and weakly developed.

The mountain slopes of the Rockies are commonly characterized by wetter soil moisture regimes and cooler soil temperature regimes than those of the Trench although soil developments may be similar to those in the Trench. As a result, the medium textured luvisolic soils have thin, weakly acidic, yellowish-brown upper mineral soil layers overlying the clay accumulation zone. On coarser textured, calcareous soil parent materials, however, weakly developed brunisolic soils similar to those at lower elevations are still common. Where non-calcareous, coarse textured soil parent materials occur, podzolic soils with deeper soil profiles and reddish brown, acidic upper mineral soil layers are common. The luvisolic soils in the non-calcareous areas commonly have podzolic or brunisolic, acidic upper soil layers above the clay accumulation zone. Thus, on lower to middle mountain elevations in the Rockies, the forest cover will likely be more dense with less herb, shrub and grass cover in the understory.

At high elevations in the mountains where soil temperature regimes are even colder and soil moisture regimes wetter, Orthic Humo-Ferric Podzols are the most commonly occurring soil development, even on calcareous parent materials. At these elevations, Podzolic Gray Luvisols

commonly occur on finer textured surficial materials while Orthic Eutric Brunisols and Orthic or Cumulic Regosols are most common on recently disturbed sites. The soils are characterized by increased organic matter contents in the surface layers, especially on the moister sites. Young soils, or those in unstable areas may be regosolic (undeveloped) or may be brunisolic soils with thin, brownish to black organic matter enriched surfaces. Podzolic soils with reddish-brown, organic matter enriched, acidic upper mineral soil layers are common on soil parent materials derived from both calcareous and non-calcareous bedrocks. Organic forest litter accumulations on the soil surface at higher elevations are generally thicker and better developed than those at lower elevations. Forests are most commonly dense, with limited quantities of understory vegetation. Limited areas of krummholz and alpine vegetation zones occur in the Rockies, and, where present, are commonly characterized by youthful Regosolic, Orthic Ferro-Humic Podzolic (krummholz), Orthic Melanic or Orthic Sombric Brunisolic (alpine or krummholz meadows) soil developments.

Large areas of the Rockies, including portions of the White and upper Kootenay River valleys, (above Gibraltar Rock), and portions of the Fernie and Flathead Basins, are characterized by presence of fine grained sedimentary and metamorphic shales, mudstones, siltstones, phyllites and argillites. Silt loam to silty clay loam textured Orthic Gray Luvisolic (low elevation valley floors only),

Brunisolic Gray Luvisolic (middle elevations) and Podzolic Gray Luvisolic (higher elevations) soil developments are most common in these areas, although youthful Brunisolic and Regosolic soils are also commonly seen. Forest cover and understory vegetation, being largely seral, is similar on these finer soils to that of other areas in the Rockies. Other extensive portions of the Fernie and Flathead Basins are characterized by coarse grained, often non-calcareous sandstones, conglomerates and quartzite bedrocks. Sandy loam to loamy sand textured Orthic Dystric Brunisols (lower to middle elevations) and Orthic Humo-Ferric Podzols (higher elevations) are the most common soil developments in such areas. Forest cover and understory vegetation patterns are similar to elsewhere in the Rockies.

Floodplain soils in the Rockies are commonly calcareous, loamy sand to sandy loam textured (locally silt loam textured) and imperfectly drained (locally poorly drained). Cumulic Regosolic, Gleyed Cumulic Regosolic and Rego Gleysolic soil developments are common. Depending upon the soil drainage and degree of fluvial activity, vegetation varies from dense coniferous or deciduous stands, to thickets of shrubs, to sedges in poorly drained fens. Throughout the valleys of the Rockies, small, localized water accumulating, depressional areas are characterized by Typic Mesisol Organic soils derived primarily from decomposition of sedge species.

3.4.3 SOILS OF THE PURCELL MOUNTAINS

Immediately west of the Rocky Mountain Trench, soils in the Purcell Mountains are very similar to those of the Trench and lower slopes in the Rockies. However, further west, non-calcareous bedrocks predominate, soil moisture and temperature regimes become wetter and cooler as the eastern-most edges of the Interior Wet Belt are entered. Orthic Dystric Brunisolic (lower to middle elevations) and Orthic Humo-Ferric Podzolic (higher elevations in wetter valleys) soil developments are most common. In areas where fine grained argillites, mudstones and siltstones occur, Luvisolic soil developments are common. Forest cover in the Purcell Mountains is commonly relatively dense at all elevations. Floodplain soils are similar in soil drainage, vegetation pattern, texture and soil development to those of the Rockies except that they are nearly always non-calcareous.

Chapter 4



PLATE 4

The Bull River Valley in the Rockies looking north from Iron Creek, September, 1944. (Government of Canada Photo, T31L-154.)

CHAPTER 4

POTENTIAL UNGULATE DISTRIBUTION

There are currently seven native ungulate species that have the capability to inhabit the study area, each with its own responses to the several ecosystems that occur there. The Ungulate Biophysical Capability maps provide a classification of each soil- terrain- vegetation unit as to the ability of that unit to support each of those ungulate species. All species are represented graphically on each unit of the drafted maps. This provides all the detail that is available plus an indication of the complex array of species that various units can support. However, it does not easily provide for the potential distribution of individual species. Therefore, the following species account is an attempt to alleviate that shortcoming.

4.1 METHODS

The field reconnaissance for the East Kootenay area project began in the summer of 1976. During this first year the inventory crew became familiar with the area's geographic features and the road access available. They also contacted various resource users and managers in the area to ascertain their needs for wildlife inventory. In addition, interviews were conducted with big game guide-outfitters, trappers, Fish and Wildlife Branch personnel and other knowledgeable individuals. From such interviews, information on winter and summer ranges, natality areas, rutting areas, migration routes, approximate times of seasonal movement and location of mineral licks was recorded on maps or in note-form.

Field checking was also conducted in the summer of 1976. This entailed making notations at selected sites, respecting the presence or absence of game trails, the relative abundance of fecal pellets, and evidence of browsing. Most of the field checking was done in areas considered to be summer range. During both the 1976 and the 1977 field seasons all actual sightings of animals were recorded on the 1:125 000 reference maps.

In the summer of 1977, 133 detailed field checks were conducted to more precisely delineate known ungulate winter ranges. At each site pellet group counts were conducted along a transect 100 metres long and one metre wide. Each transect was divided into four 25 metre sections. In each 25 metre section the number of pellet groups of each species was recorded (mule deer, white-tailed deer and bighorn sheep pellets were combined where those species occurred together). The percentage cover of plant species, including browsing use were also recorded. Other site features that were recorded were elevation, slope, soil type, land-form, soil texture, moisture regime, surface shape, major slope position, vegetation zone and community and previous land use. Taking into account the foregoing features, the degree of browse and historical information, an "on-site" ungulate species capability rating was then made.

The final stage of mapping ungulate capability was based on soil map units. The resulting wildlife maps

show a mosaic of small, irregularly shaped areas which are referred to as "wildlife biophysical units". Each wildlife biophysical unit is described by a "wildlife unit symbol" which consists of several letters that are defined individually in the legend of the 1:50 000 scale wildlife maps. In delimiting wildlife units, the mapper attempted to outline areas that were homogeneous with respect to landforms, surficial materials, soils, vegetation and potential ungulate use.

4.2 POST-GLACIAL UNGULATE HISTORY

Since the large valley glaciers retreated about 11,000 years ago (Ryder 1981) the climate has changed several times. Clague (1981), summarized the works of several authors and stated that the early post-glacial times were as warm as or warmer than the present, but, there were also short-lived cold intervals during which alpine glaciers advanced (probably less than 2 kilometres beyond present ice margins). He stated further that a period of dry, hot climate occurred between 3500 and 7500 years ago, which was followed by a generally cooler, moister period which was also punctuated by sharp climatic fluctuations. There were at least 3 periods of glacial expansion; one between 4000 and 5000 years ago, and one within the past few centuries. These climatic fluctuations would have profound influences on the plant communities, and the wildlife populations.

A varied large mammal population, that was much different from the current population, no doubt

existed in the study area post-glacially. There is a strong possibility, undocumented however, that bison (of unknown species, North American horse and pronghorn antelope occurred here (Grant Keddie 1982, personal communication). There is even a chance that both the mastodon and mammoth occurred here, since both species were still in existence in North America at this time. Large woodland caribou herds are also believed to have existed throughout the study area (Gay Fredrick 1982, personal communication).

Bison were known to have existed west of the Rocky Mountains, in the mountainous prairies and valleys of Montana at the time of early Euro-American exploration (Johnson 1969, Masten et al. 1981). It had been assumed that there were outlier herds from the short grass prairie (Roe, 1952), but more likely these were relict herds that had survived from early post-glacial times when a grassland environment was prevalent throughout the Pacific Northwest region (Grant Keddie 1982, personal communication). Similarly, the woodland caribou herds that currently exist in the Purcell Mountains are, undoubtedly, relict herds that had flourished in the alpine-like environment of the post-glacial period.

4.3 ROCKY MOUNTAIN ELK

Rocky Mountain elk are presently the most plentiful and widely distributed ungulate in the East Kootenay (Figure 4.3). Only mule deer have the capability to be as numerous and as widespread, although

their current population is much reduced from their historical numbers or potential. Elk are a highly mobile species and can traverse long distances from winter range to summer range. They are also capable of utilizing a wide variety of habitats and can be found throughout the study area utilizing all habitats except boulder fields, glaciers, cliff faces and the upper limits of alpine tundra.

The main winter ranges consist of grasslands and pioneer seral shrub lands at low elevations on rolling to moderately slopping terrain with medium to dense forest cover or well developed riparian areas. In areas of deeper snowfall, mature coniferous forest cover becomes vital for thermal cover.

Summer ranges consist primarily of the subalpine basins and valleys with avalanche chutes (that support herbaceous vegetation) and floodplains. Nearby timber cover and wet seeps, springs or bogs are extremely important.

In the study area summer range for elk is very extensive and widely dispersed so that no one geographical area is better suited for elk than in any other area. The possible exception is the dry forests of the Trench which are used as winter ranges and which are generally vacated during the summer. (However, the cultivation of alfalfa crops has enhanced the summer range capability for elk in the Trench even though the inherent natural summer capability is low.) There are few elk in large expanses of north and east facing slopes

except when forced off their traditional ranges during the hunting season.

Traditional spring and fall ranges for elk occur mainly on southerly and westerly facing slopes where the forage is most nutritious. Cows and calves seek out higher nutritious forage in spring, summer and fall, than do the bulls. It is the mature cows that select the breeding sites, not the bulls. When the elk are heavily hunted, they move on to the north and east facing slopes and either forage on less favourable sites, move long distances between feeding and bedding areas or become more nocturnal in their feeding habits.

The most important winter ranges for elk occur in the Trench and in the middle reaches of the Elk valley. It is here that most of the elk survive the rigors of winter. However, there is some wintering in many of the other major river valleys, i.e. the Upper Kootenay and the White River, Fording River, Moyie River, Wigwam River and the Flathead River; also there are winter ranges at high elevations in the Fording River watershed where grasslands occur at high elevations.

4.4 MULE DEER

Mule deer, like elk, have the capability to become widespread and numerous throughout the study area (Figure 4.4). However, current population trends indicate that mule deer are not as numerous as their potential habitat would allow. Mule deer

utilize a wide variety of habitats.

Winter ranges traditionally consist of pioneer-seral shrublands of the dry forest zone in areas with broken terrain or steep and windswept slopes. Often large herds remain at high elevations until December before migrating to the low elevation winter ranges.

The most important winter ranges for mule deer occur in the Trench in the upper Kootenay, lower Lussier and Moyie River valleys, and in the middle reaches of the Elk valley. Almost all mule deer of the project area over-winter here, although small populations overwinter in the White, Wigwam, Flathead and Palliser River valleys.

Summer ranges consist primarily of subalpine basins and south to west facing mountain slopes. Spring and fall ranges occur mainly on medium to high elevation, south and west facing slopes. Summer range for mule deer is very extensive and like the elk, there is no one geographical area in the study area that is better suited for mule deer than in any other area. However, the dry forests of the Trench, which are used as winter ranges, are generally vacated during the summer. Floodplains are not preferred habitat for mule deer.

4.5 WHITE-TAILED DEER

White-tailed deer are restricted primarily to valley bottoms in the study area (Figure 4.5). Lands capable of supporting them lie within the distribution limits of Douglas-fir, which occur in all the major side

valleys at lower elevations. White-tailed deer can adapt to the cultivation of land particularly where adjacent forests exist for use as hiding cover.

Winter ranges consist of pioneer seral shrublands at low elevations, particularly on south to southwest facing slopes and riparian habitat before the snow depths become too deep. Grasslands are also used at the time of spring thaw. The most important winter ranges for white-tailed deer occur in the Trench, with some winter ranges in the Moyie Valley and only limited values in the middle reaches of the Elk valley. The majority of the large population of white-tailed deer which summer in the Flathead valley in the study area migrate to lower elevations along the North Fork of the Flathead River in Montana.

Summer ranges consist of the floodplains and adjacent terraces, particularly when covered by dense forest. Cultivated fields are also prime feeding sites during the summer. Summer ranges exist throughout the valley bottoms and the best summer ranges occur where the riparian habitat is well developed, as is the case of the larger drainages such as the Elk, Kootenay, Bull and Flathead rivers.

Spring and fall ranges occur along the valley bottoms as the animals engage in the semi-annual migration.

4.6 MOOSE

In the study area there are two subspecies of moose, the smaller Wyoming moose that inhabits the Flathead valley and the Canada moose that occurs throughout the remainder of the study area. There may in fact be a large zone where hybrid Canada X Wyoming moose occur. These two subspecies and the hybrids react similarly to the available habitat and therefore neither are considered to have any different habitat requirements. Moose are associated with the valley bottoms and riparian habitat except in the Rocky Mountain Trench where they occur only infrequently (Figure 4.6). As well, moose occupy the lower terraces and slopes of the mountain valleys. Where the relief is somewhat subdued, as in the McGillivray Range and Morrissey, Fernie, Leach and Greenhills Ridges, habitat capable of supporting moose occurs to the tops of the mountains. Moose can also be found on occasion in the subalpine basins and alpine slopes, although these habitats are not considered to have a high potential.

Winter ranges consist of the floodplains and riparian habitat that exist in the valleys throughout the study area; and on the adjacent forested terraces, or aspen dominated forested slopes.

Summer ranges consist of the same type of habitat as the winter range with the floodplains, riparian habitat and adjacent forest slopes providing most of the summer range. In addition there is a wider use of the smaller valleys and most of the lower, forested slopes.

The most important winter ranges for moose occur in the Flathead and Elk River valleys. Moderate capability winter ranges occur along many of the tributary streams such as Upper Kootenay, White, Bull, Wigwam, Moyie and Yahk Rivers and Hawkins, Gold, Tepee, Linklater, Joseph, Mather, Dutch, Alexander, Michel, Leach and Lodgepole Creeks. There is also some winter range capability for moose in the Trench, particularly the riparian areas of Sand Creek, St. Mary River, Mather Creek and the Columbia River.

4.7 ROCKY MOUNTAIN BIGHORN SHEEP

Rocky Mountain bighorn sheep prefer habitats characterized by steep grasslands and broken krummholz terrain. Lands capable of supporting them lie east of the Columbia and Kootenay rivers (Figure 4.7). In the study area there are two distinct bighorn sheep ecotypes which can be defined on the basis of the use of the available habitats. Most of the Rocky Mountain bighorn sheep fall within the ecotype that winter on low elevation, southerly exposed slopes that are also adjacent to rocky or glaciolacustrine terrace escarpments or talus slopes. During the summer and fall periods the bighorn sheep migrate to higher elevations and utilize the steep, rocky alpine and krummholz areas and the dry forests that occur on the upper slopes of the Rockies. The second bighorn sheep ecotype winter on high elevation, windswept, alpine-like ridges and steep slopes. These bighorn move down into the subalpine forests for the summer and fall periods.

The most important winter ranges

for bighorn sheep of the low elevation ecotype occur in the Trench along the base of the Rocky Mountains, while the most important winter ranges for bighorn sheep of the alpine ecotype occur on the crest of Ewen Ridge in the Elk valley. Several small populations that may be of the alpine ecotype are scattered throughout the Rockies.

In addition to the low elevation or the high elevation winter ranges there are three other sites that bighorns can utilize during the winter. These are windswept alpine-like ridges, which may be well within the elevational limits of tree growth that occur between the Elk and Bull Rivers in the Van Nostrand Range and in the Simpson River valley, Sheep Mountain and Erikson Ridge. Several winter ranges occur in seral sites of dry-burned over forests, areas which are typically in rain shadows and where the topography is sufficiently rugged to provide snow-free areas. Of note are Mount Broadwood or "China Wall", Bighorn Creek, White Swan Lake, Cross River and Whitetail Brook. Finally, some bighorn sheep overwinter at high elevations in south to west facing areas that have steep rock cliffs and scattered trees and quite often moderately deep snow; these areas can occur on just about any mountain in the Rockies.

Summer range for bighorn sheep is generally in the upper portions of the mountains in the alpine tundra, subalpine basins and krummholz areas. However, bighorns use the dry forests on adjacent steep, rocky terrain as escape habitat. Summer range habitat is generally close to winter range

habitat and nursery bands of ewe, lambs and yearlings often reappear on winter ranges during the summer for short periods.

4.8 MOUNTAIN GOATS

Mountain goats prefer habitats characterized by high, rugged, treeless mountain terrain. As a consequence, mountain goats occur throughout the Rocky Mountain portion of the study area wherever the mountains are high enough to have alpine tundra or krummholz vegetation and the rock strata are competent enough to provide good escape terrain, for example limestone dolomites (Figure 4.8). Mountain goat habitat was rated in only three areas west of the Kootenay and Columbia Rivers, as, unlike bighorn sheep, mountain goats do occur in the Purcell Mountains to the west of the study area.

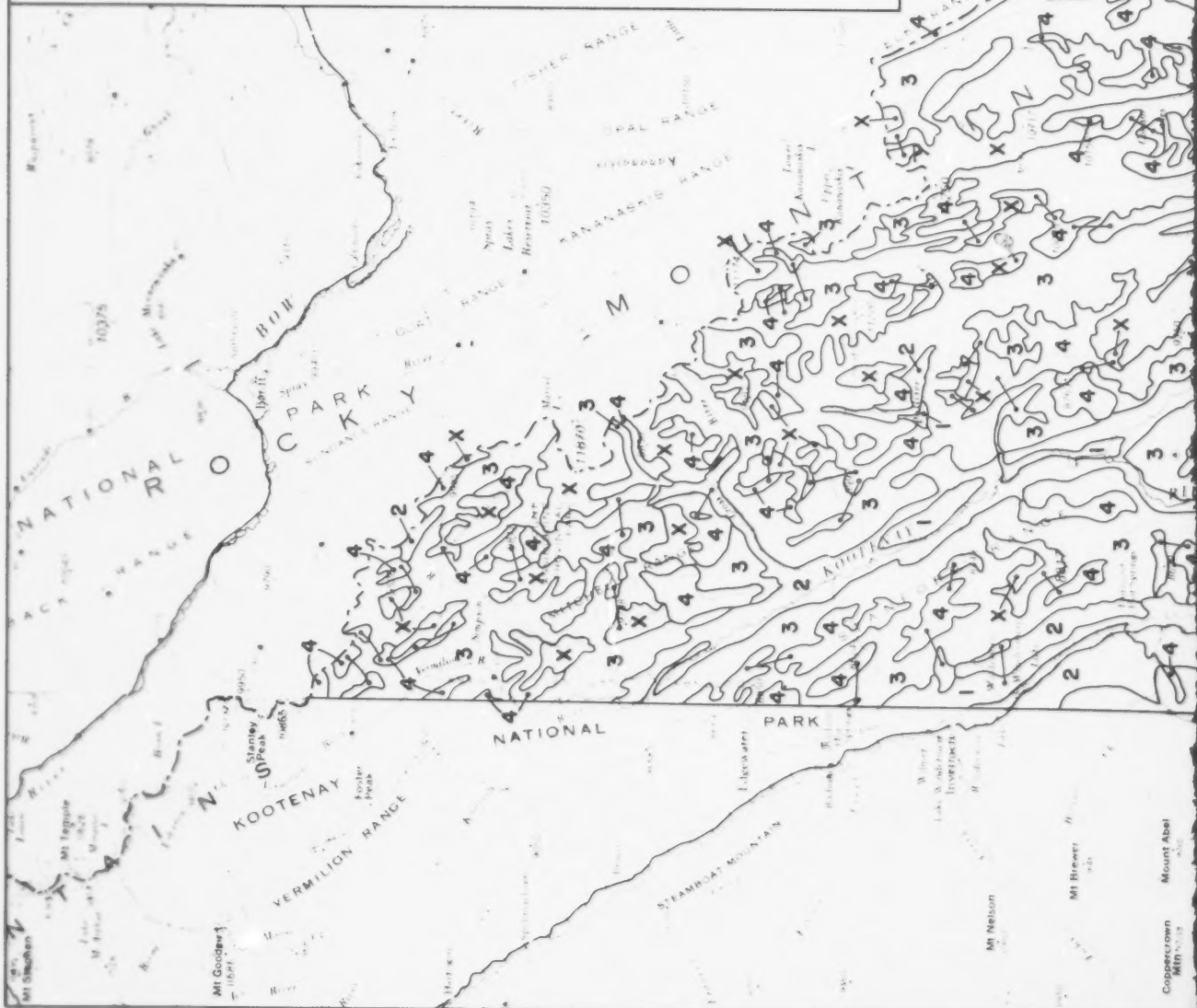
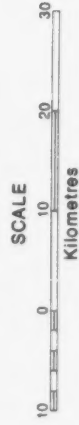
4.9 WOODLAND CARIBOU

Woodland caribou are the least numerous ungulate in the study area as there is only a limited area of habitat that can support them (Figure 4.9). Summer range for caribou occurs in the watershed of Lamb and Perry Creeks and the Moyie River within the Moyie Range. Winter range occurs in the Subalpine Engelmann spruce - alpine fir zone of the Interior wet belt region to the west of the study area.

The animals that summer in the study area represent one of two small populations that are at the southernmost limits of caribou distribution in North America. These herds are composed of only a few caribou which have a wide distribution throughout the year.

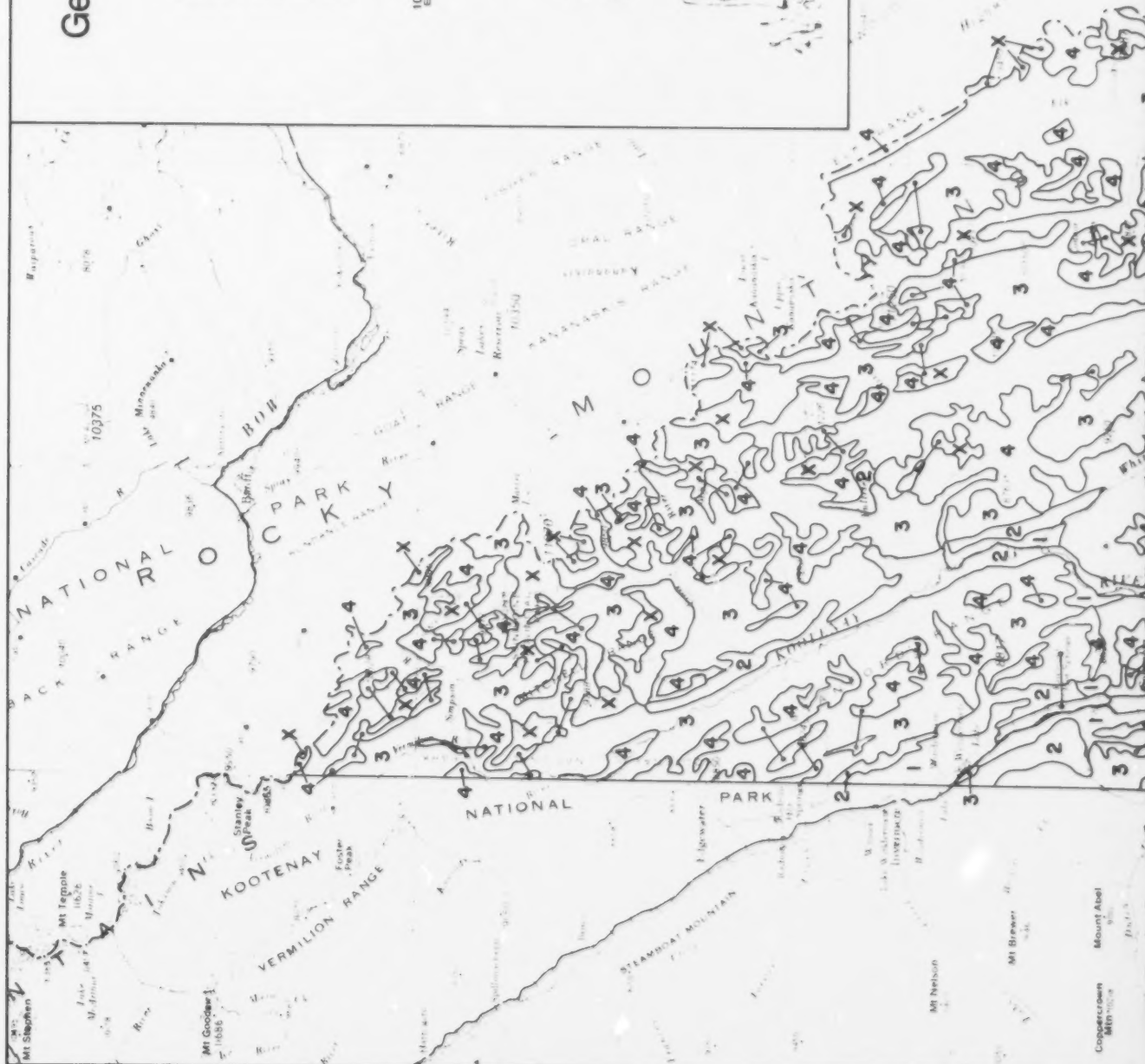
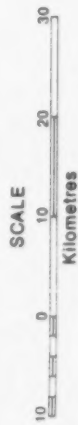
Generalized Capability for Elk

1	Class 1 and 2 Winter Range
2	Class 3 and 4 Winter Range
3	Class 3 and 4 Summer Range
4	Class 5 Summer Range
X	Class 6 No Capability



Generalized Capability for Mule Deer

1	Class 1 and 2	Winter Range
2	Class 3 and 4	Winter Range
3	Class 3 and 4	Summer Range
4	Class 5	Summer Range
X	Class 6	No Capability



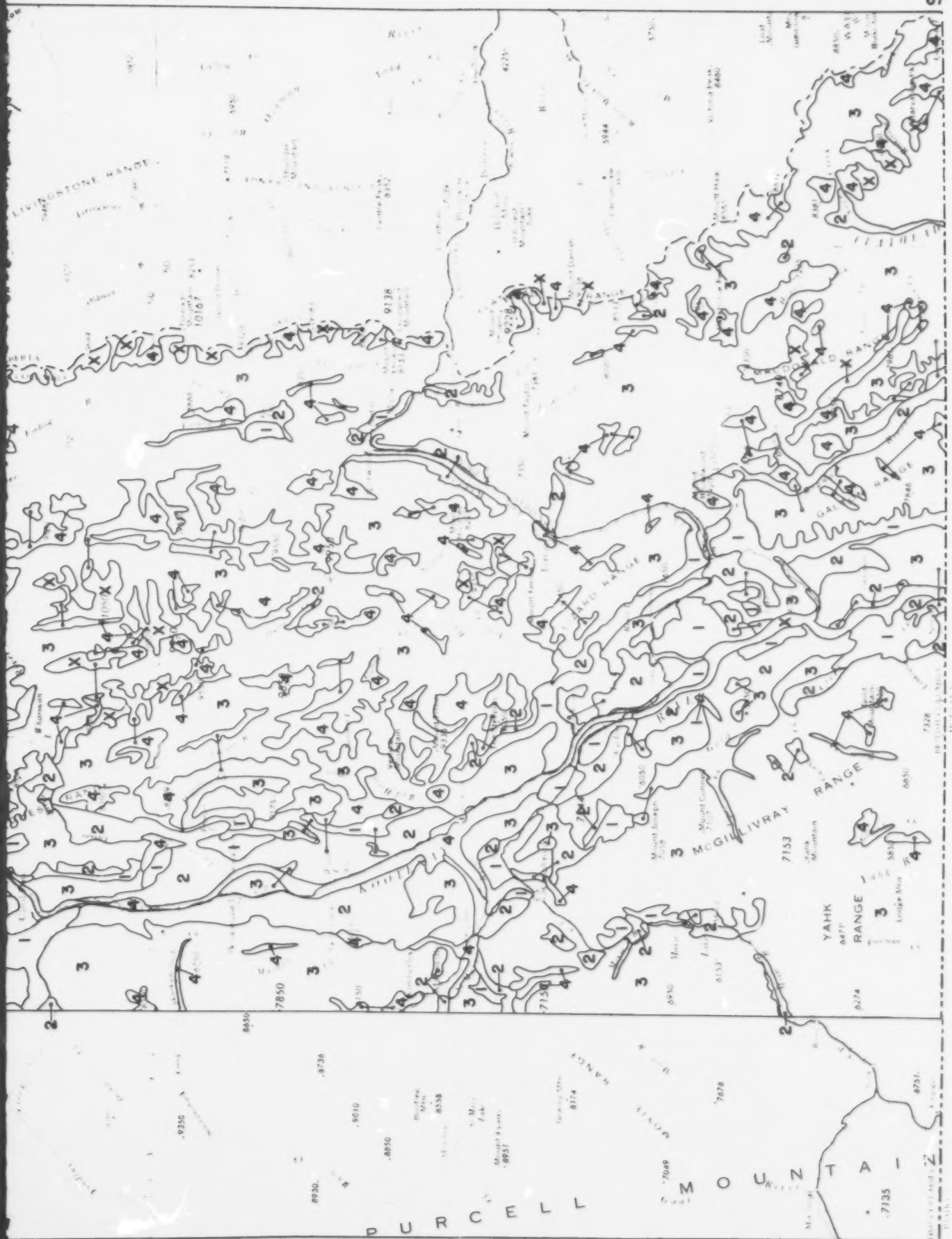
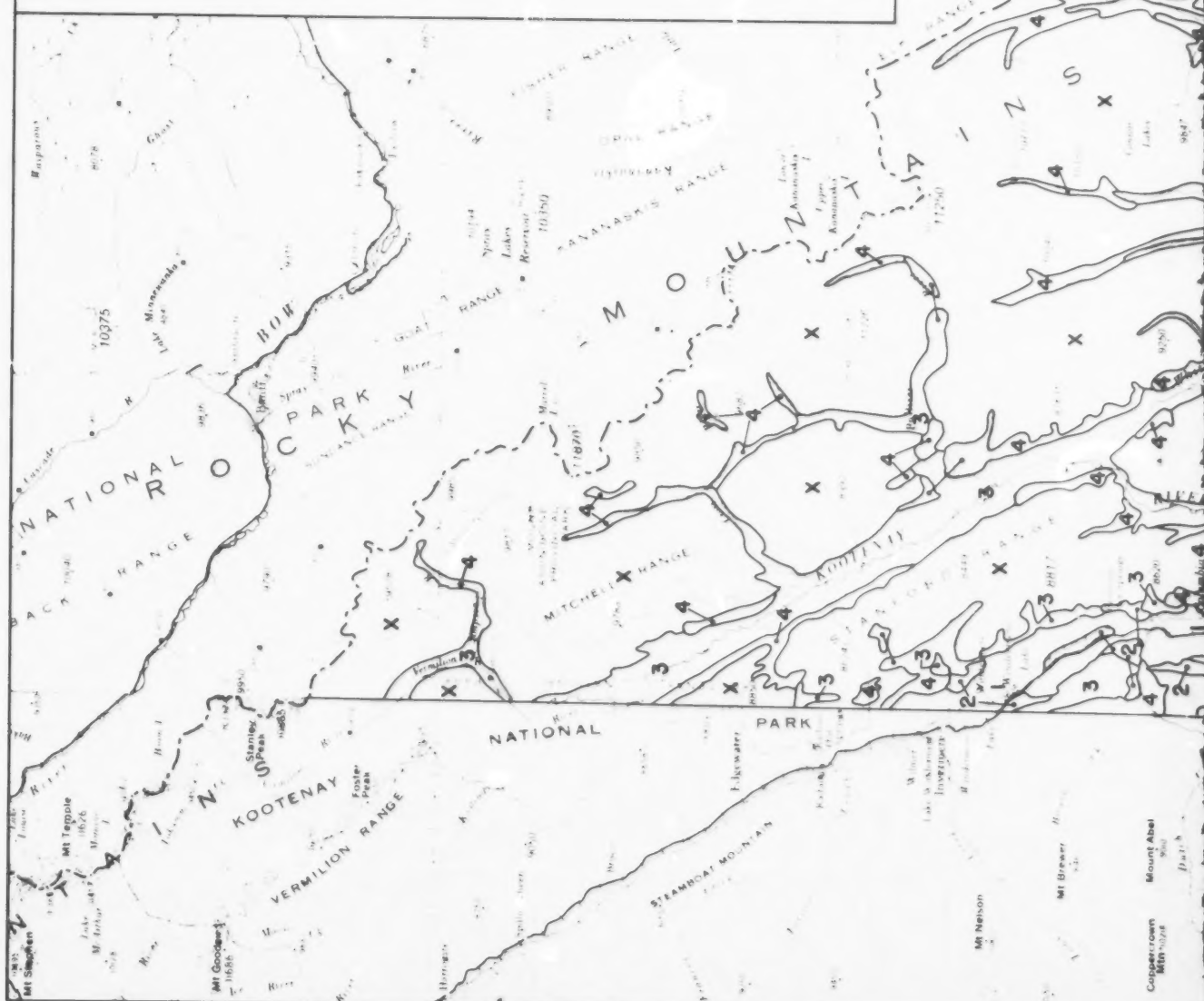
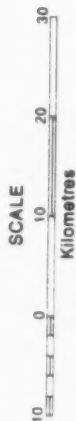


FIGURE 4.4

Generalized Capability for White-tailed Deer

1	Class 1 and 2 Winter Range
2	Class 3 and 4 Winter Range
3	Class 3 and 4 Summer Range
4	Class 5 Summer Range
X	Class 6 No Capability



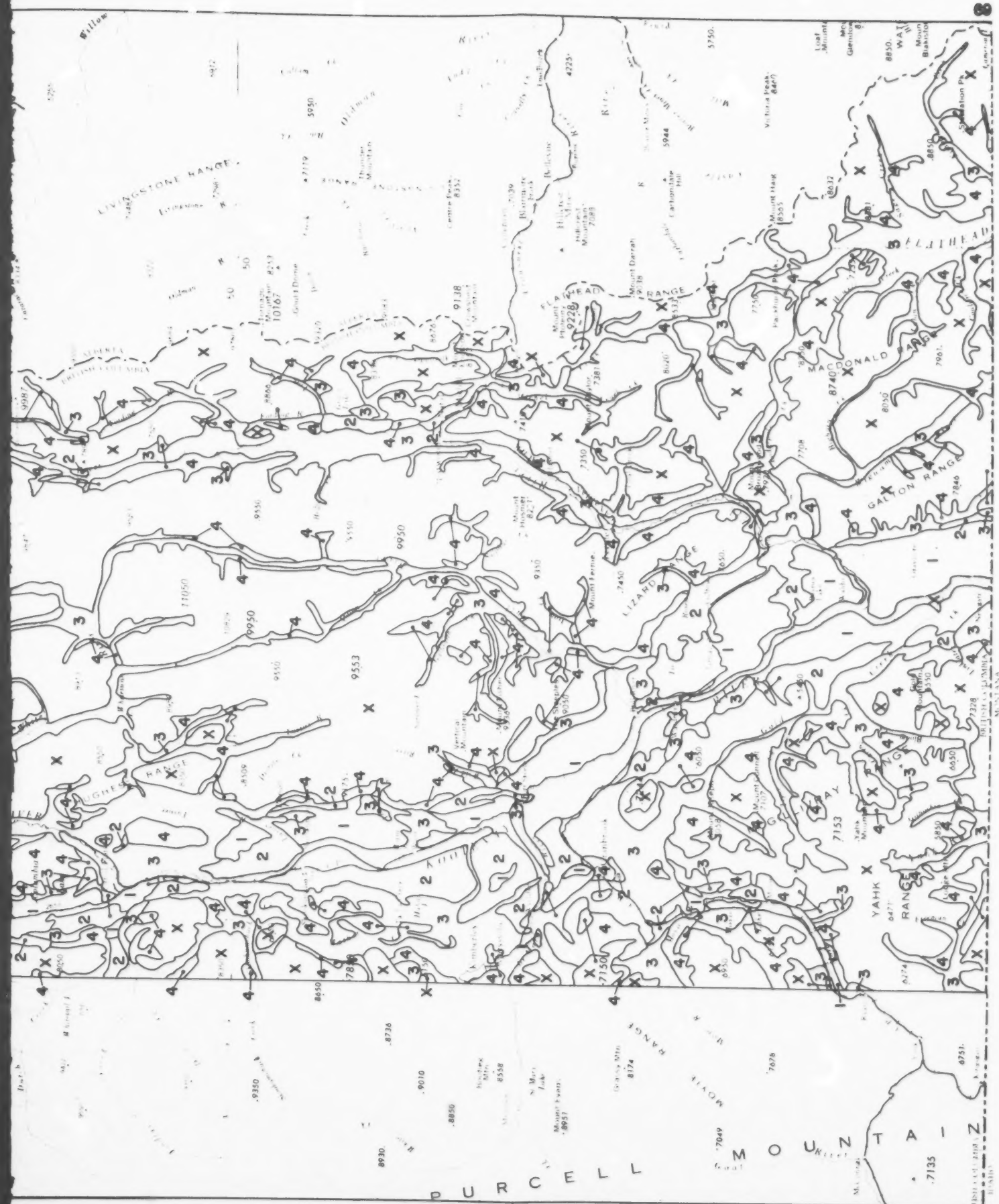


FIGURE 4.5

Generalized Capability for Moose

- 1 Class 1 and 2 Winter Range
- 2 Class 3 and 4 Winter Range
- 3 Class 3 and 4 Summer Range
- 4 Class 5 Summer Range
- X Class 6 No Capability

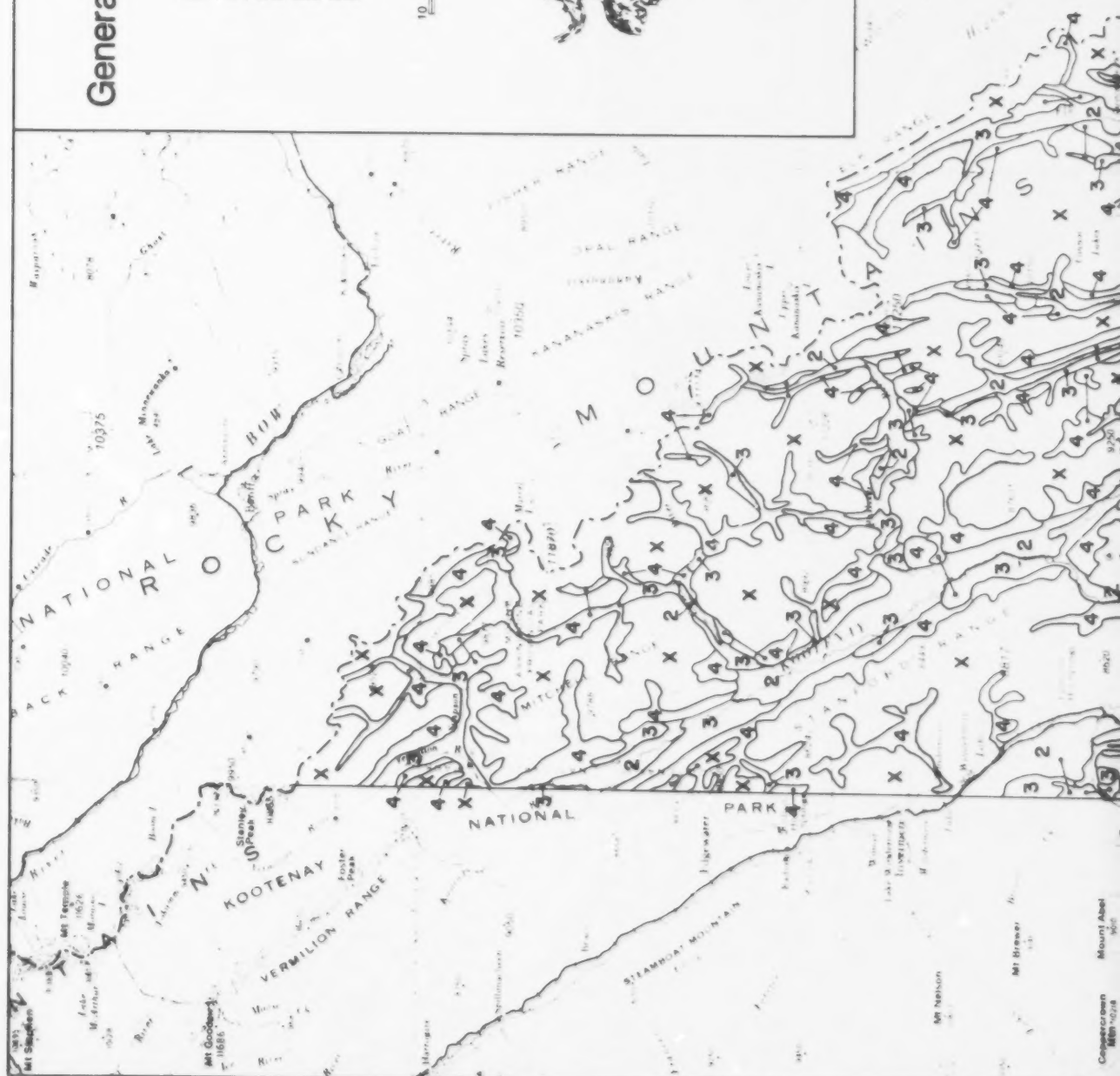
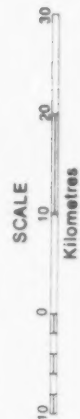
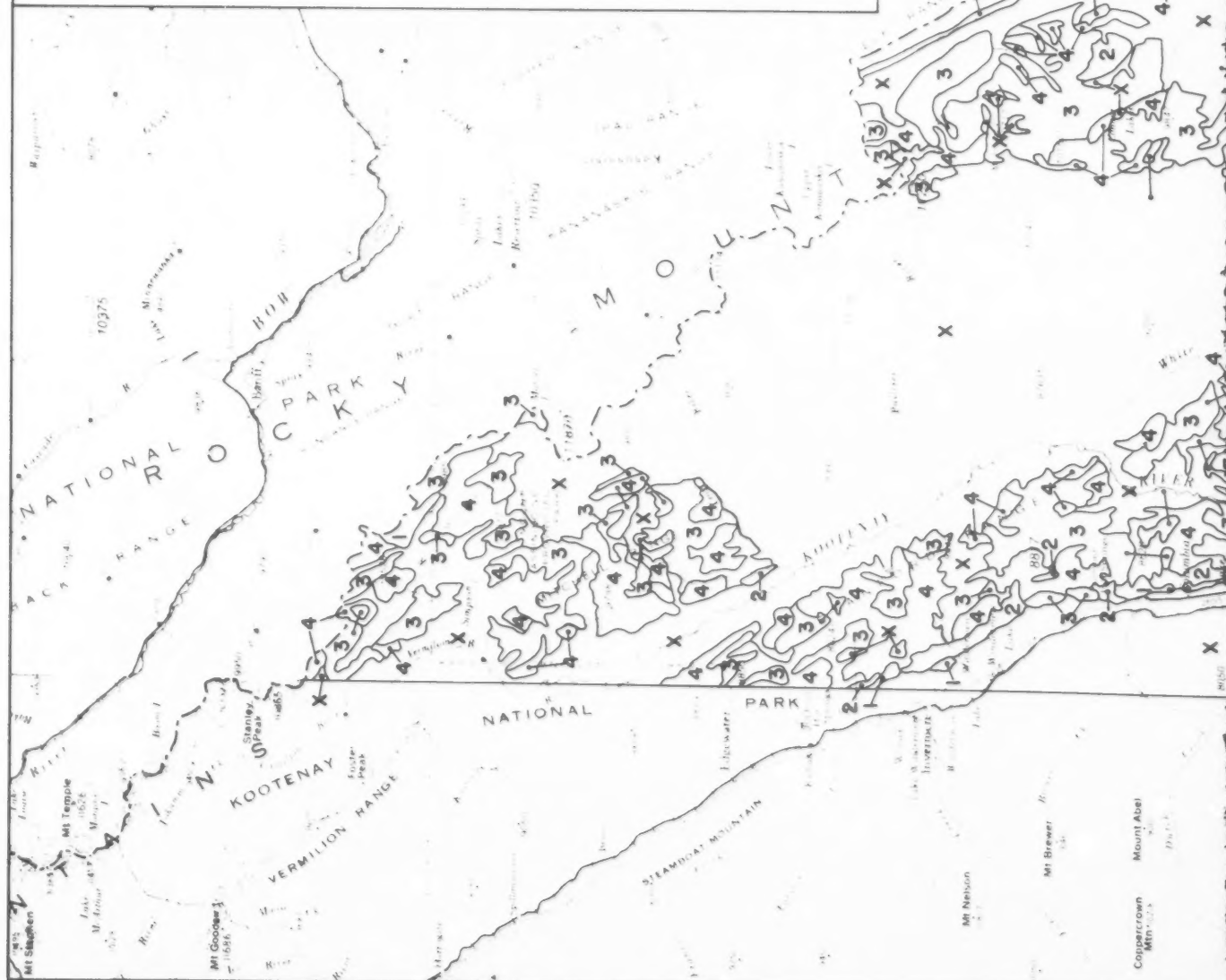




FIGURE 4.6

Generalized Capability for Rocky Mountain Bighorn Sheep

1	Class 1 and 2 Winter Range
2	Class 3 and 4 Winter Range
3	Class 3 and 4 Summer Range
4	Class 5 Summer Range
X	Class 6 No Capability



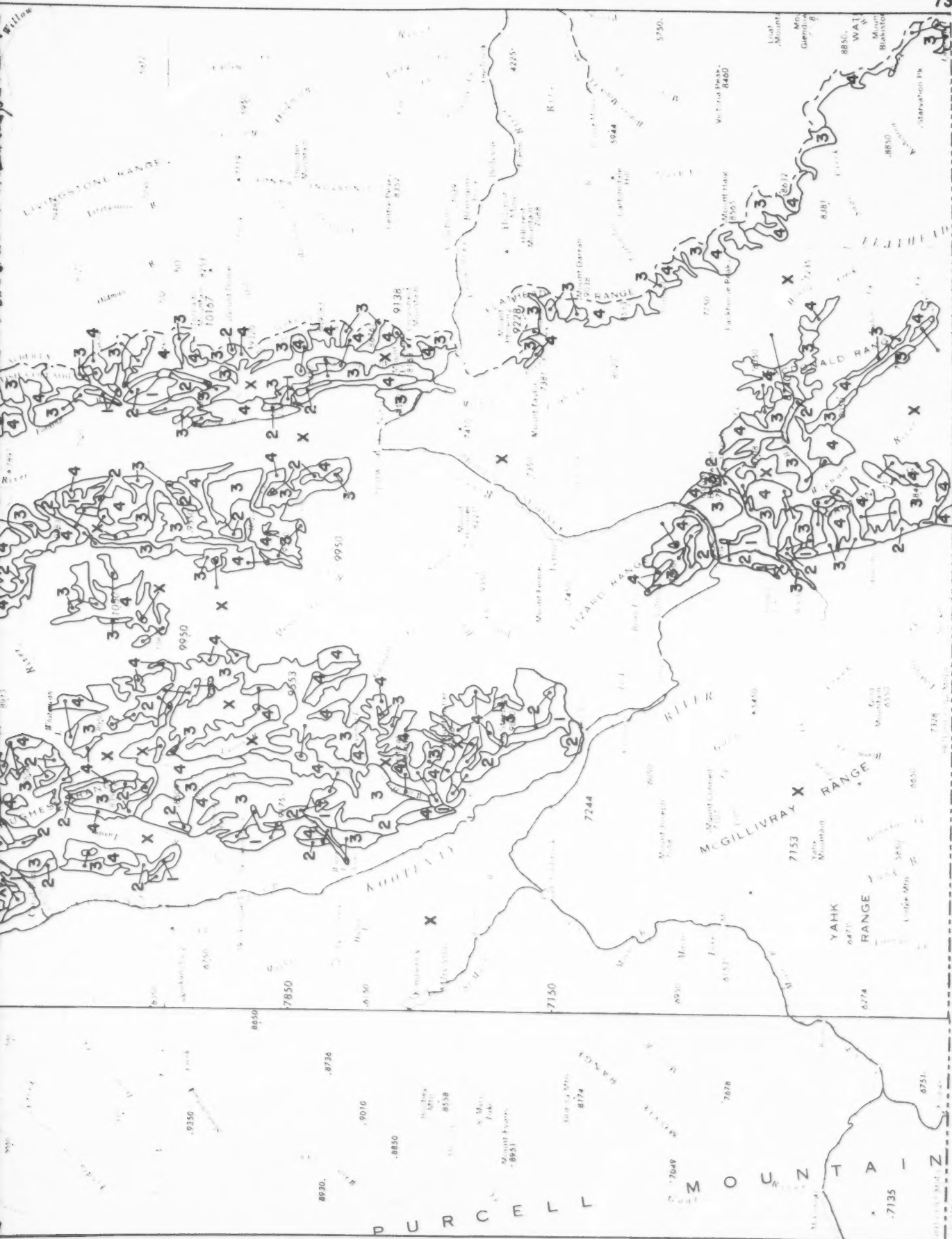


FIGURE 4.7

Generalized Capability for Mountain Goats

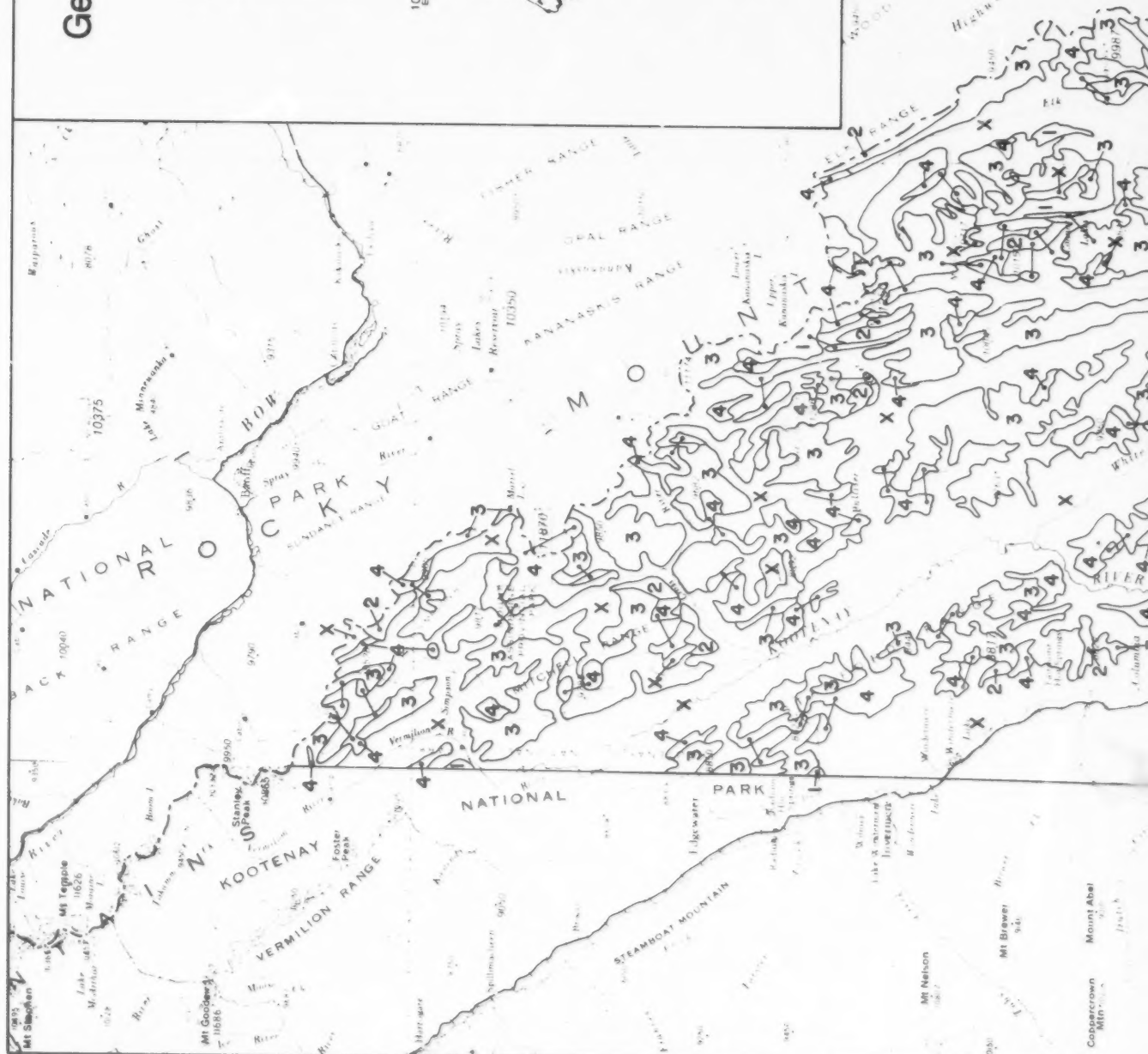
1	Class 1 and 2 Winter Range
2	Class 3 and 4 Winter Range
3	Class 3 and 4 Summer Range
4	Class 5 Summer Range
X	Class 6 No Capability

SCALE

10 0 10 20 30
Kilometres

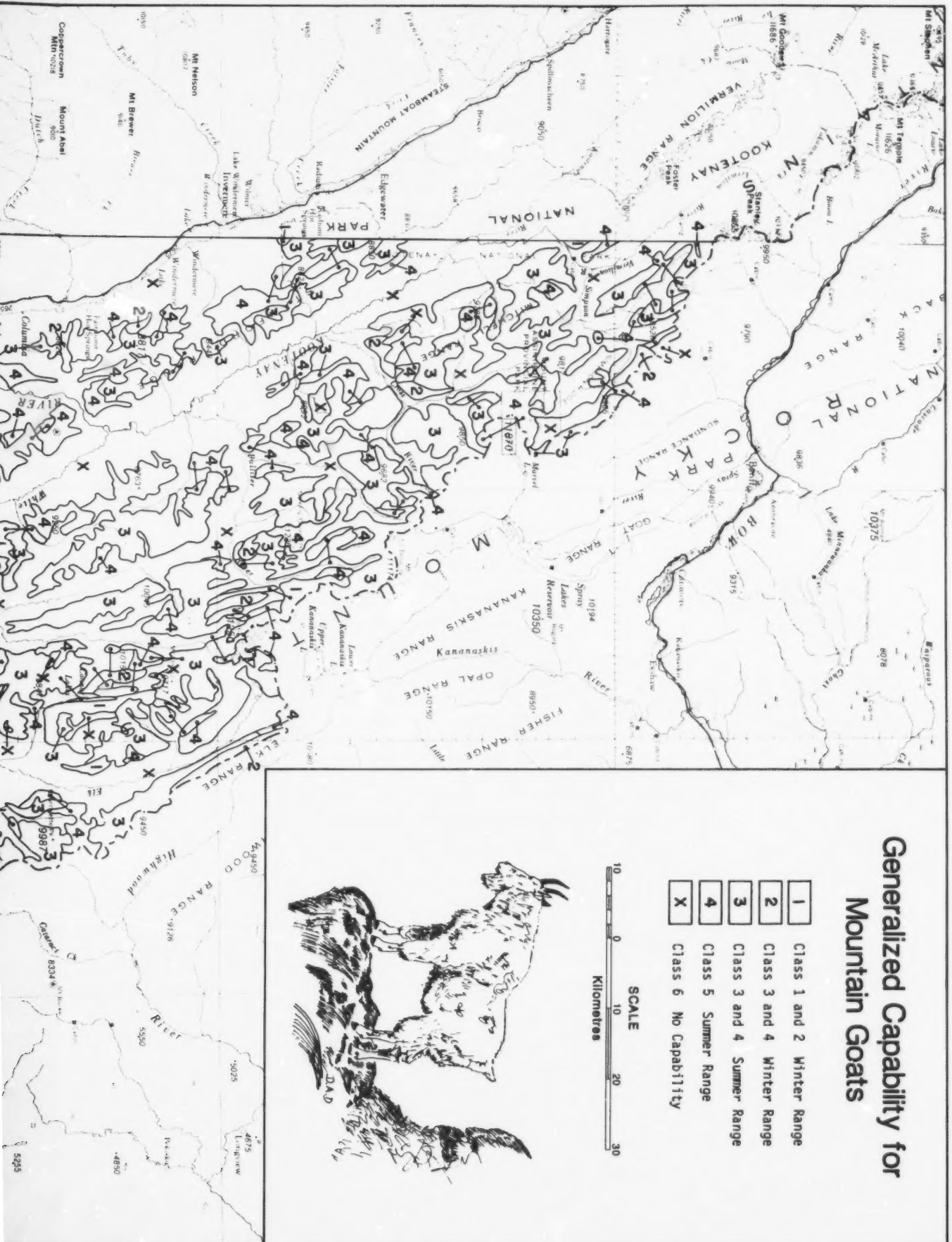
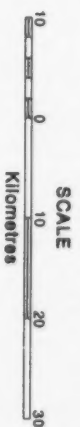


1	Class 1 and 2 Winter Range
2	Class 3 and 4 Winter Range
3	Class 3 and 4 Summer Range
4	Class 5 Summer Range
X	Class 6 No Capability

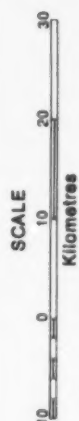


Generalized Capability for Mountain Goats

1	Class 1 and 2 Winter Range
2	Class 3 and 4 Winter Range
3	Class 3 and 4 Summer Range
4	Class 5 Summer Range
X	Class 6 No Capability



1	Class 1 and 2	Winter Range
2	Class 3 and 4	Winter Range
3	Class 3 and 4	Summer Range
4	Class 5	Summer Range
X	Class 6	No Capability



Chapter 5



PLATE 5

Thunder Creek in the White River watershed, 1949. (B.C. Government Photo, B.C. 895:81.)

CHAPTER 5

RECOMMENDATIONS FOR THE MANAGEMENT OF UNGULATE HABITATS

5.1 PLANNING OPTIONS

Resource conflicts in the East Kootenay are many and varied. The high value of the wildlife resources can be seen as a focal point for many of these conflicts. For the most part, the wildlife resources can achieve their assumed capability values only in a particular wilderness setting. That means, lands that are subjected to periodic natural fires in order to remove trees, to stimulate shrub production, recycle nutrients and to protect the large, mature trees. Appropriate portions of the land base must not be dissected by roads or railroads, nor should they be cleared and plowed. Access should be minimal and human activity, especially during the winter months, should be non-existent. Obviously the removal of land from food and cover production is detrimental to wildlife; therefore, the urbanization process, hydro reservoir impoundments and strip mines cannot be construed as being beneficial to wildlife.

Some practices such as prescribed burning, selective logging and prescribed and controlled grazing can be useful management tools that can supercede the role of natural fires and large wild ungulate herd grazing. But usually these man-implemented practices are accompanied by roads, access, disturbance and by the land alienation and urbanization needed to support the people who provide the management, all of which alter wild-

life habitat. Table 5.1 outlines the potential resource conflicts that exist for each ungulate species in five major geographical areas in the in the study area.

The East Kootenay has a variety of ecosystems; some are closely related, while others are quite diverse. Each ecosystem has its own set of environmental parameters which set limits on ungulate species capabilities, habitat management options and resource use conflicts. In addition, management of one ecosystem can often have an effect on ungulate populations in other ecosystems. There were many ways to organize the discussion of wildlife habitat management options: i.e., physiographic units, watersheds, administrative units, vegetation zonation or biophysical soils units. Each had their advantages and their disadvantages. The system that provided the best continuity within physiographic regions and grouped sites of similar biophysical potential while at the same time creating only a few units, was a stratification of ecological units based on criteria described by Lea (1984) for forest subzones and major wetland edaphic areas (Figure 3.3). Being intrazonal (similar flora and soils regardless of sub zone) and often critical wildlife habitat, the wetland habitats in all major subzones have been separated as a distinct ecological unit in this bulletin (see Section 5.5). For each ecosystem, there is a general description of the climate, landform, terrain, soils and vegetation successional patterns. A description of the various ungulate species use and potential use of each ecological unit

TABLE 5.1

POTENTIAL RESOURCE CONFLICTS IN THE EAST KOOTENAY THAT CAN LOWER THE SUITABILITY OF THE LAND TO PRODUCE WILDLIFE.

Species Affected	Rocky Mountain Trench	Purcell Mountains	Rocky Mountains	Fernie Basin	Flathead Basin
ELK MULE DEER WHITE- TAILED DEER MOOSE	fire prevention livestock grazing land alienation corridor develop- ment reservoir impound- ment	fire pre- vention access development land aliena- tion	fire pre- vention access development land aliena- tion	coal ex- ploration coal mining land aliena- tion corridor development access development logging* fire pre- vention	coal & gas explora- tion coal mining logging* access dev- elopment fire pre- vention
BIGHORN SHEEP	fire prevention livestock grazing land alienation corridor develop- ment	N/A	access development mineral exploration fire preven- tion	mineral exploration access development fire preven- tion	N/A
MOUNTAIN GOAT	N/A	access development mineral exploration	access development mineral exploration	N/A	N/A
WOODLAND CARIBOU	N/A	logging access development wild fires	N/A	N/A	N/A

N/A means not applicable because species being considered does not occur in that physiographic area.

* logging in the riparian habitats

follows. Finally, a description of the management or planning options is provided which if implemented, would enable each ecosystem to be managed for its capability to support each ungulate species (disregarding other possible land uses).

When considering management and planning options available to the wildlife manager or the problems that current population demand and resource extraction have on wildlife, a variety of initiatives become evident. The variety of ungulate species and the complexity of habitats that those species utilize increases the array of management or planning options available. The management option trade-offs are not simple; each ungulate species has evolved to utilize different niches. That may mean different geographical areas, e.g. mountain goats in the alpine and white-tailed deer adjacent to riparian habitat. But more often it means different species would utilize the same habitat only under different successional stages, e.g. mule deer would utilize a site with open, seral shrub/grasslands, whereas white-tailed deer would utilize the same site only if it were in an immature Douglas-fir/ponderosa pine forest successional stage. For the following discussion, management practices are considered to be those activities that can be applied to the land base, and that will manipulate the vegetation in such a way as to be beneficial to a given ungulate species. Wildlife planning practices are defined as efforts that influence the policies or activities of other resource users so as to minimize habitat loss, disruption or dissec-

tion of habitat continuity or directly affect the behaviour of individual animals.

5.2 MANAGEMENT PRESCRIPTIONS

Capability means the ability of the land to support an empirically derived number of each ungulate species on a sustained basis, under certain management prescriptions, as defined by Hills et al. (1973). Within this study each land unit was assessed a separate rating for each ungulate species. Table 5.2 outlines the basic management prescriptions that are required for each ungulate species in order to achieve the potential density levels derived for the four basic types of winter range that were found in the study area. The potential management practices assumed include prescribed burning or logging, controlled and prescribed grazing, access limitations and fire prevention.

5.3 PONDEROSA PINE AND WESTERN LARCH-PONDEROSA PINE SUBZONES OF THE INTERIOR ROCKY MOUNTAIN DOUGLAS-FIR ZONE

5.3.1 DESCRIPTION OF AREA

This is the driest and warmest ecological unit in the project area. It is characterized by hot, dry summers and cold, dry winters. The least snowfall of the East Kootenay area occurs here, and it is the first to ablate in late winter through the action of wind and warmer temperatures. This ecological unit occurs from above the floodplain of the Kootenay River to approximately 1050

TABLE 5.2 GENERALIZED MANAGEMENT RECOMMENDATIONS FOR ACHIEVING MAXIMUM WINTER RANGE CAPABILITY VALUES FOR SEVEN UNGULATE SPECIES WITHIN FOUR MAJOR ECOLOGICAL UNITS IN THE EAST KOOTENAY.

Ecological Unit	Major Landform Position	Elk	Mule Deer	White-tailed Deer	Moose	Bighorn Sheep	Mountain Goat	Woodland Caribou
Wet Edaphic Valley Bottoms in the Dry Interior Region	Valley Bottoms, Floodplains and Low Terraces	- prescribed burning - prescribed logging - prescribed cattle grazing	- prescribed burning - prescribed logging - prescribed cattle grazing	- prescribed burning - prescribed logging - prescribed grazing	- prescribed burning - prescribed logging	N/A	N/A	N/A
Interior Rocky Mountain Douglas fir Zone	High Terraces, Lower Mountain Slopes & Hills	- prescribed burning - prescribed cattle grazing - prescribed logging	- prescribed burning - prescribed logging - prescribed cattle grazing	- prescribed burning - prescribed logging - prescribed cattle grazing	- prescribed burning - prescribed logging	- prescribed burning - prescribed logging - prescribed cattle grazing	- prescribed burning - protection from logging, mineral exploration or access	N/A
Subalpine Engelmann Spruce-Alpine fir Zone & Interior Wet Belt	Mountain Forests Variable Elevations	- prescribed logging - access management	- prescribed burning - prescribed logging - access management	N/A	- prescribed logging - prescribed burning - access management	- protection from logging, mineral exploration or access	- protection from logging or mineral exploration - access management - fire protection - prescribed logging	- protection from mineral exploration - access management - fire protection - prescribed logging
Alpine-like Environment	High Windswept Slopes and Ridges	- prescribed burning - protection from logging, mineral exploration or access	N/A	N/A	N/A	- prescribed burning - protection from logging, mineral exploration or access	- prescribed burning - protection from logging, mineral exploration or access	- protection from logging, mineral exploration or access - fire protection

N/A not applicable, the ungulate referred to does not winter in the outlined habitat.

* controlled winter logging in caribou habitat is currently in an experimental stage.

metres elevation. On the dry, south to southwest facing slopes it may extend to 1500 metres. The majority of the Ponderosa pine subzone of this ecological unit is found south of Kikomun Creek and Elko south to the British Columbia/Montana boundary and east of Koocanusa reservoir to the base of the Rocky Mountains (see Figure 3.4). Another major location of this subzone is south of Skookumchuck Creek and the lower Lussier River to about Pechams Lake and Rampart Prairie. The western limits are near the 1000 metre elevation on the west side of the Rocky Mountain Trench and the eastern limits are near the 1350 metre elevation on the east side of the Trench. The Western larch - ponderosa pine subzone is found between the Ponderosa pine subzone and the Lodgepole pine subzone in the Rocky Mountain Trench (see Figure 3.3). It occurs from the Kootenay River floodplain to 1050 metres in elevation. On exposed southerly aspects this subzone may extent 1500 metres. This subzone is found in three main areas, namely: the Trench floor from Fairmont Hot Springs south to near Skookumchuck; in the lower valleys of Perry Creek, Joseph Creek and Moyie Creek; and, the Trench floor from Rampart and Pechams Lake south to the British Columbia-Montana border (except that area occupied by the Ponderosa pine subzone).

The principal surficial materials are extensive areas of glacial till and glaciofluvial deposits which combine to form a broad, rolling to flat plain in the Rocky Mountain Trench. There are some small areas of rock outcrops and colluvium,

especially along the base of the Rocky Mountains.

The seral stands in the Ponderosa pine subzone are commonly dominated by ponderosa pine, with Douglas-fir frequently present, and western larch is absent. In cooler, moist locations in this subzone, lodgepole pine and trembling aspen may be found. Generally, the forest stands are open in response to the warm, droughty spring and summer conditions and to man's activities which inhibit regeneration of trees. The understory is dominated by shrubs such as antelopebrush (bitterbrush), common grasses such as bluebunch wheatgrass, rabbitbrush, common Saskatoon and rough fescue, Idaho fescue and prairie koeleria. Forest cover within this subzone has been historically kept open due to frequent ground fires, high surface temperature, severe moisture deficiencies and high lime content in the soil, all of which tend to inhibit tree regeneration. In more recent times overgrazing by domestic livestock has also been an inhibiting factor to tree growth. Areas supporting ponderosa pine are slow to succeed to climax Rocky Mountain Douglas-fir forests. However fire control practices and more recently, controlled livestock grazing have resulted in a substantial increase in tree cover and the establishment of Douglas-fir.

The seral forest stands in the Western larch-ponderosa pine subzone are dominated by ponderosa pine and western larch with varying amounts of Douglas-fir, lodgepole pine and trembling aspen. Stands are commonly

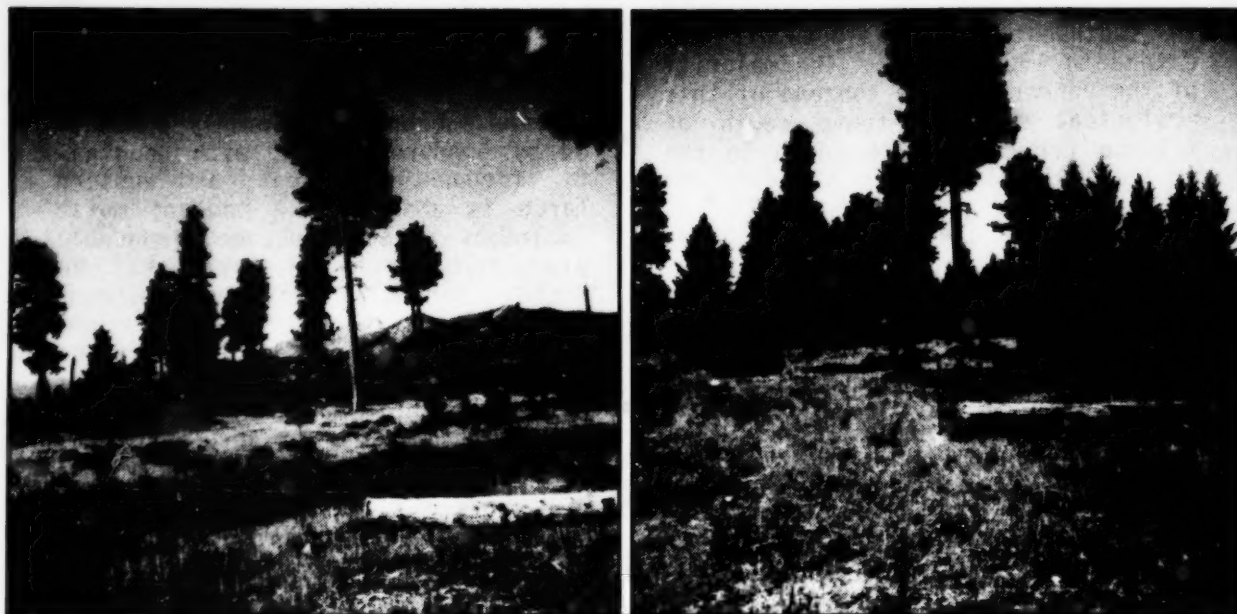


PLATE 5.3.1.1

The logging and forest fires of the 1920's and 30's reduced the forest canopy for several decades. In the photograph on the left, taken on August 9, 1970, only the mature trees dominate the treed canopy; fourteen years later, on July 25, 1984, the photo on the right shows that immature trees have taken over the treed canopy.

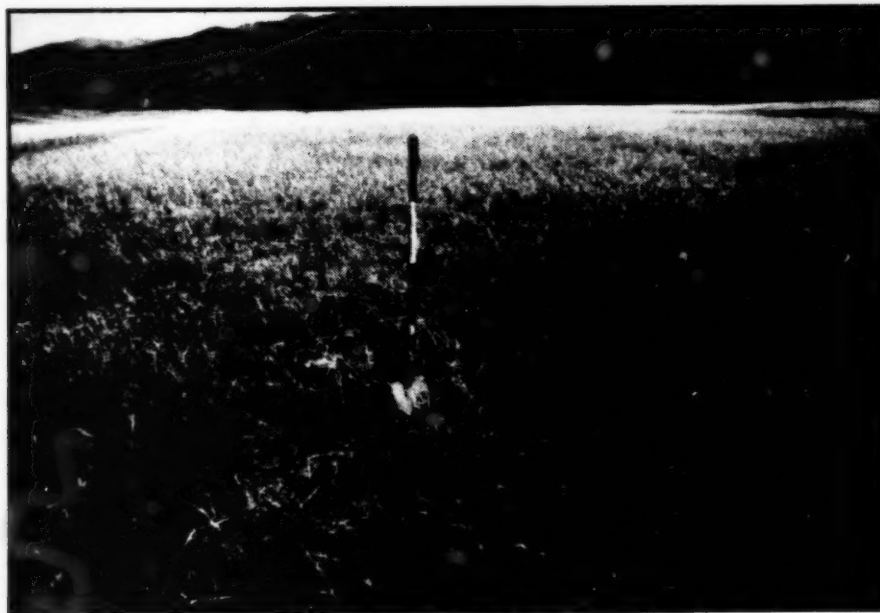


PLATE 5.3.1.2

A needle-and-thread grass dominated site on Tobacco Plains, abusive grazing practices in the past have removed the climax bluebunch wheatgrass/Idaho fescue community.

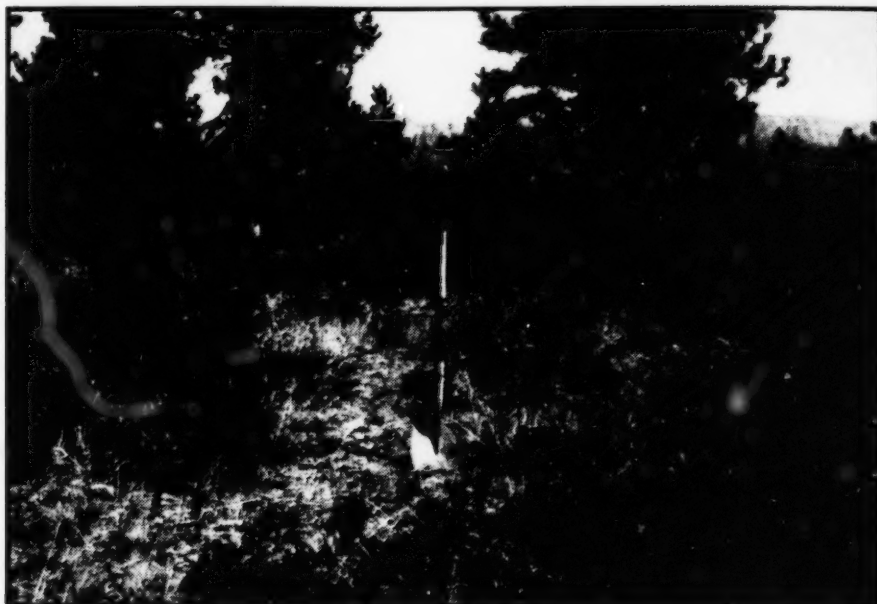


PLATE 5.3.1.3

Bitterbrush, Columbia needlegrass and rough fescue in an open ponderosa pine and Douglas-fir forest on the Luckhurst Range unit.



PLATE 5.3.1.4

Snowbush ceanothus and Canada bluegrass on the Pickering Hills.



PLATE 5.3.1.5

Bluebunch wheatgrass and bitterbrush on Premier Ridge.



PLATE 5.3.1.6

A forested stand within the ponderosa pine - western larch subzone; this stand has western larch, ponderosa pine, pinegrass and kinnikinnick.

more closed in this subzone than in the Ponderosa pine subzone and the understory is dominated by soopolallie, birch-leaved spirea, common Saskatoon and pine grass. In areas of droughty, coarse-textured soils, stands may be more open and dominated by ponderosa pine with an understory of common Saskatoon and bluebunch wheat grass. On more protected sites Douglas-fir is able to regenerate in the shade of the closed canopies. The important elk and mule deer winter forage species snowbush ceanothus, occurs on mesic sites within this subzone. The soils of this ecological unit most commonly feature shallow developments above highly calcareous parent materials. On dry sites, grassland soils are commonly characterized by organic enriched horizons. Finer textured surficial materials commonly produce soils with clay enriched subsurface horizons (which have significant effects on soil moisture, soil nutrients and soil drainage factors).

5.3.2 UNGULATE SPECIES USE

5.3.2.1 Elk

Some extremely high winter use capability exists where the habitat can be managed as a mixed, open grassland/forest habitat. Winter range values for elk are slightly lower on coarse textured soils of level, fluvial terraces as well as on remnants of glaciolacustrine terraces that have open grassland plant communities. On higher slopes winter range capabilities are also lower. This ecological unit provides the highest capability ranges for

wintering elk in the East Kootenay. Most of the current elk population winter here.

Low capability summer range for elk exists in more densely forested areas. However, most of the elk leave this subzone by late spring for higher and cooler environments.

5.3.2.2 Mule Deer

Some extremely high capability mule deer winter ranges exist in this ecological unit, particularly on southerly facing, medium to coarse-textured soils and units with rock outcrops and colluvium. There are also broad units of moderate winter range capability; these are generally characterized by both gentler topography and by deeper, variably textured soils that are weathered primarily from glacial tills. The flat-lying coarse and fine textured fluvial terraces and glaciolacustrine terraces generally have no capability as winter range for mule deer and are used only as transitional ranges primarily in the spring/early summer period.

There is virtually no summer range capability for mule deer in this ecological unit, and all of the mule deer leave for higher elevation units.

5.3.2.3 White-tailed Deer

Winter range capability for white-tailed deer is highly variable in this ecological unit. Large units of extremely high winter capability habitat are found on areas of more

subdued topography especially in the areas south of Rampart or Pechams Lake. However, large units of low winter range capability exist on the grassland habitats on coarse textured, level, fluvial terraces and on shallow soils over bedrock.

Summer range capability for white-tailed deer is highly variable. Open grassland areas have low summer range capability whereas, units with a forest canopy, particularly adjacent to riparian habitat, have a high capability.

5.3.2.4 Moose

As the vegetation is not suitable there is virtually no summer or winter moose capability in the non-riparian units of this subzone. There is some winter range capability within the large riparian areas (see Section 5.5).

5.3.2.5 Bighorn Sheep

Some extremely high capability bighorn sheep winter ranges exist in this ecological unit. Such units are characteristically steep colluvium slopes, rock outcrops, plus the escarpments of incised water-courses located adjacent to these sites. The preferred habitats are grasslands and shrub/grasslands. There is very little summer range capability for bighorn sheep in this subzone; however, some herds of ewes and lambs may return to their winter ranges during the summer for short periods.

5.3.2.6 Mountain Goats

Except for one area of steep southfacing rock and talus, there is no mountain goat capability in this ecological unit.

5.3.3 Management Recommendations

This ecological unit represents two vegetation subzones that have the greatest land use conflicts in the project area. Most of the significant livestock/wildlife conflicts occur here. There is a high potential for all-terrain vehicle/wildlife conflicts. Land alienation due to clearing and building construction is an important concern. The ecological unit is the one in which most of the large urban centres and most of the small rural centres occur. In addition it is also the location of major highways, roads, railroads, pipelines, power transmission lines and a reservoir. Several intensively used recreational sites are also located here.

Management of habitat for elk and white-tailed deer should maintain an uneven sized forest canopy of varying openness. Logging should be either selective or restricted to pre-commercial thinning and "one pass" small clearcuts; Christmas tree cutting to provide thinning of the thicker regenerating stands. Forests adjacent to the grasslands should be maintained in order to reduce the size of the openings. Forests adjacent to the urban centres should be maintained as a buffer zone to provide cover from human disturbances although consideration should be given to spacing the stands and applying prescribed burning to

reduce the fire hazard.

Fire is a valuable tool and an essential element in the rejuvenation of shrub/grassland stands in recently disturbed and young seral stages. The intent should be to provide open shrub/grassland stands of young vigorous growing shrubs and bunch grasses surrounded by areas of forest of mixed ages. Thus feeding sites will be provided adjacent to areas of both hiding and thermal cover. Consideration should be given to fall burning where opportunities exist to increase the density of both snowbush and red-stemmed ceanothus, while spring burning is the prescription of choice for areas occupied primarily by antelope bush and Saskatoon.

The steeper, southerly facing sites of shallow soils over bedrock should also be burned in order to eliminate any forest establishment and also to rejuvenate the shrubs and bunch grasses. Sites with steep slopes and calcareous soils most commonly will not regenerate to forest cover. Escarpments or glaciolacustrine terrace remnants in this ecological unit are sensitive to surface erosion if subjected to too intense a burn. But, cool burns will provide high capability forage for bighorn sheep and mule deer during the winter and as spring forage for elk, white-tailed deer, bighorn sheep and mule deer. Controlled livestock grazing, as provided for in a rest and deferred rotation grazing regime, is also a useful tool to be applied to areas that have received logging and burning manipulation of the habitat. Properly applied livestock

grazing can be useful in maintaining vigorous, youthful bunch grasses which are highly palatable to elk.

The potential of this ecological unit to realize its high ungulate capabilities will ultimately depend on land use planning. Control of urban sprawl; road, highway and railroad construction must be limited; and land alienation must be curtailed in areas of high ungulate winter capability. Land alienation and road construction often dissect deer winter ranges. While this may not reduce the ability of the remaining land to provide necessary ungulate habitat, disturbance associated with such alienations can affect the animal's distribution throughout that unit.

Off-road vehicle recreational use can create a disturbance to ungulates, causing them to vacate important feeding and hiding sites. Thus, if ungulate use is to be maintained in this subzone, off-road vehicle activity must be planned and efforts made to restrict it to low capability wildlife biophysical units.

5.4 LODGEPOLE PINE SUBZONE OF THE INTERIOR ROCKY MOUNTAIN DOUGLAS-FIR ZONE

5.4.1 Description of subzone

This is the upper subzone of the Interior Rocky Mountain Douglas-fir zone, occurring upslope from the Ponderosa pine subzone and Western larch ponderosa pine subzone in the Cranbrook section to about 1350 metre elevation; in the Radium section, it



PLATE 5.4.1.1

A mature Douglas-fir, pinegrass, flat-topped spirea community in Lewis Creek.



PLATE 5.4.1.2

A bluebunch wheatgrass and rubber rabbitbrush community surrounded by an open canopied Douglas-fir forest at Armstrong Bay on Columbia Lake.

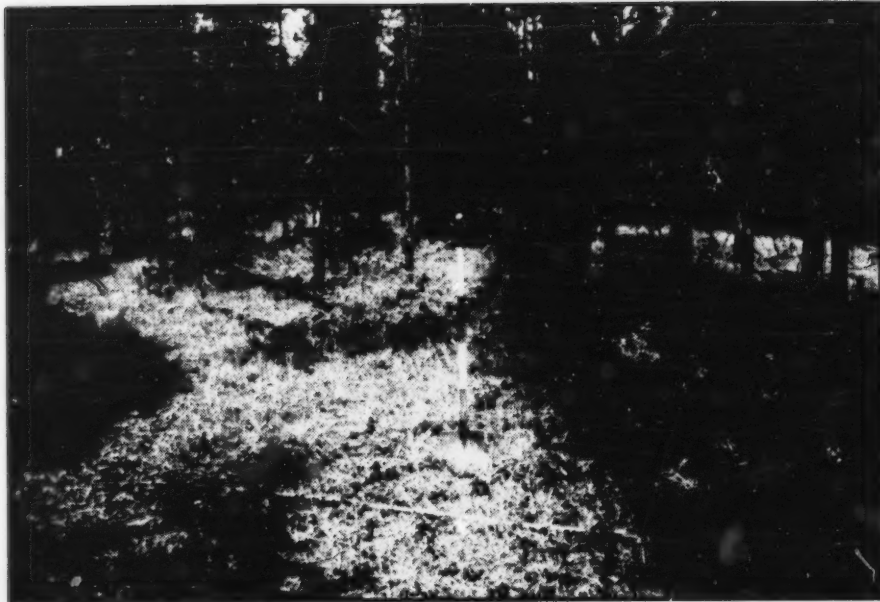


PLATE 5.4.1.3

A lodgepole pine, kinnikinnick, trailing juniper and pinegrass community in the lower Lussier River Valley.



PLATE 5.4.1.4

In the lodgepole pine subzone of the Interior Rocky Mountain Douglas-fir zone, where there is a favorable aspect and the materials cannot hold much moisture, a grass dominated community can develop. This site is in the Upper Kootenay River Valley south of the Palliser River.

occurs from the floor of the Rocky Mountain Trench to 1200 metre elevation. On the southerly facing slopes it may extend to 1350 metres in the Radium section and to 1800 metres in the Cranbrook section. This subzone extends up the valleys of the major rivers in the Rocky and Purcell Mountains, namely the Upper Kootenay, White, Lussier, Bull, Elk, Wigwam, St. Mary, Moyie and Yahk rivers and Dutch, Findlay and Skookumchuck creeks.

The principle surficial materials are fluvio-glacial and glacial till plains in the river valleys and rock, colluvium and till along the lower mountain slopes.

The climate of this subzone is a gradient between the hot, droughty lower ecological unit and the moister, cooler ecological unit above. Snow is persistent throughout winter, particularly in forested sites, but solar radiation on south-facing aspects is effective in snow ablation. The spring and summer periods are warm and droughty, while the winter period is typically cold. The climate in several large valleys of the Rockies, such as the upper Kootenay, Bull, Elk and Wigwam Rivers represent rainshadows and thus also support this subzone along the valley floors.

In this ecological unit closed stands of lodgepole pine, with or without western larch and Rocky Mountain Douglas-fir, predominate as a result of past forest fires. These three tree species are seral components on a variety of soils and topographic positions. They dominate

on mid-slope areas of medium textured soils. Trembling aspen may also be a forest component throughout this subzone.

The understory is generally dominated by shrub species such as soapberry, birch-leaved spirea, creeping Oregon-grape, common juniper and Saskatoon. The herb layer is generally dominated by pine grass and various combinations of heart-leaved arnica, showy aster, northern twin-flower, dwarf blueberry and rough fescue. Red-stemmed ceanothus occurs in the more southerly reaches of this subzone, primarily on the east side of the Rocky Mountain Trench.

As with the two previously mentioned forest subzones, most soils have highly calcareous substrata, but as this subzone is very extensive, deeper, more acidic soils are also common in areas of non-calcareous bedrock. Soils with clay enriched horizons are common on finer textured surficial materials. These soils are typically deficient in nitrogen.

5.4.2 UNGULATE SPECIES VALUES

5.4.2.1 Elk

Capability to support elk during the winter is highly variable in this subzone, depending primarily on the amount of snowfall and the aspect. Some extremely high capability winter ranges occur in the Rocky Mountain Trench. For example: the terraces and slopes of the east and west sides of Columbia Lake; on the rolling topography east of Windermere Lake; the southerly facing mountainside slopes from Lussier

River south to the Wigwam River; and, the rolling till plains on the west side of the Trench from St. Mary River to the British Columbia-Montana border. Moderate and low capability winter ranges are most common in major mountain valleys of the Rocky Mountains. As the snow is deeper in the Purcells, with the exception of the lower elevations south facing aspects the mountain slopes there have no winter range capability, while the valley floors have some limited winter range capability, particularly adjacent to the riparian zone.

Most elk leave this subzone for the summer, but not as readily as they do the preceding ecological unit. More dense forest canopies and cooler summer temperatures provide favourable summer habitat conditions for elk especially in the side valleys.

5.4.2.2 Mule Deer

Some extremely high capability mule deer winter ranges occur within this subzone and with few exceptions there are no high capability winter ranges above this subzone. In both the mountains and the Trench herb and shrub dominated sites on southerly facing slopes have high capability habitat for wintering mule deer. Moderate capability winter ranges occur on valley floor topography characterized by a greater accumulation of snow, or where the snow is less ablated.

Especially in the Trench, only extensive areas of mule deer summer

range occur on seral shrublands and forested areas on lower terraces. Most mule deer leave the Trench portion of this subzone in the summer period; however, extensive use is made of this subzone during the spring and fall. The mountain valley areas of this subzone commonly have a moderate mule deer summer range capability.

5.4.2.3 White-tailed Deer

Very few high capability, white-tailed deer winter ranges occur in this subzone. The Windermere Valley is the exception. Where they do occur, the high capability winter ranges are southerly facing slopes that are the upper extensions of winter ranges centred in lower subzones. Low capability winter ranges occur in the Trench from Grave Lake to Michel Creek in the Elk River Valley and along the southerly facing slopes of the Moyie River Valley.

Some high capability white-tailed deer summer ranges occur in this subzone, particularly in the valley tributaries of the Rocky Mountain Trench. In this subzone lower capability summer ranges occur higher on the mountain slopes.

5.4.2.4 Moose

Besides the high capability moose winter ranges consisting of riparian areas in this subzone (see Section 5.5) some high capability winter range also occurs in valley bottom areas characterized by deciduous vegetation. Similar sites in the Trench have moderate winter range

capability, as do areas of deeper snow accumulation in the side valleys.

Extensive summer range capability for moose occurs in the wetter valley floor units of this subzone, particularly adjacent to riparian habitat.

5.4.2.5 Bighorn Sheep

Several high capability bighorn sheep winter ranges occur within this ecological unit on the lower slopes of the Rockies within the Trench. Such sites are typically steep, southerly facing aspects with shallow soils over bedrock. Several low capability winter ranges occur adjacent to high capability winter ranges; these are equally as steep, dry and droughty but their aspect is not quite as favourable for quick snow ablation during the winter.

Within this subzone extensive bighorn sheep summer range capabilities occur on the lower slopes of the Rockies fronting on the Trench. Summer use of this subzone is usually transitory, as some animals, primarily ewe and lamb herds, return to the winter ranges for short periods. Most of the bighorn sheep leave this ecological unit during the summer period.

5.4.2.6 Mountain Goat

Mountain goat use of this ecological unit is limited since steep, southerly facing, colluvial and rocky areas are not common here. Exceptions occur mainly on the slopes of the Rockies from the Lussier River

south to the Elk River, and at one location in the upper Moyie River valley. These sites would be used primarily during the winter period; however, some animals would be present on these sites year round.

5.4.3 MANAGEMENT RECOMMENDATIONS

Due to its location in the major valleys of the mountains as well as in the Trench bottom north of Columbia Lake, this subzone is subjected to extensive transportation corridor developments. All major highways and railroads pass through this subzone. Most of the small resource based cities and towns are also located in this subzone, namely Kimberley, Fernie, Sparwood, Elko and Jaffray, plus the recreational centres of Windermere and Fairmont Hot Springs. Land alienation for extensive uses, such as ranching, tends to be restricted to the valley bottoms and level till plains. Most of the forests in this subzone have been logged or burned in the past, and Christmas tree harvesting is actively being pursued, primarily in the Trench. Concomitant with forest harvesting activity an extensive road network has been developed.

Wildlife management within this subzone should aim to provide both feeding sites and cover. Cover can be more easily provided in this subzone for winter ranges located in adjacent, drier subzones. In the side valley winter ranges where snow can be both persistent and deep for lengthy periods, cover should also be maintained. However, there are some extremely valuable high capability elk, mule deer, and bighorn sheep

winter ranges located on southerly facing, steep, shallow soils that should be maintained in an open seral shrub/grassland state by burning. Important forage species such as snowbush ceanothus, red-stem ceanothus and Saskatoon must be burned periodically in order to maintain vigor and to aid in seedling establishment.

Logging the Douglas-fir stands of this subzone, except for the steep, southerly facing slopes should be selective with emphasis placed on removing lodgepole pine and preserving the Douglas-fir. Logging should also maintain tree canopy or create only small clearcuts that will provide short distances from feeding site to cover. Sites of predominantly lodgepole pine should be clearcut in configurations which approximate natural forest age/type boundaries. Pre-commercial thinning and commercial thinning for minor wood products such as fence posts are beneficial in maintaining proper spacing or for creating small openings in the forest canopy as well as promoting a variable stand structure.

A scheme of deferred grazing by cattle would be beneficial to elk forage species such as bunch grasses. However, there is little area for application of such a practice except in the Columbia valley and on the east side of the McGillvray Range. The remaining areas are either too steep or too cool and moist to benefit from such a management tool.

Highways, railroads and narrow gravel roads appear to be the most common problem next to fire control

in this subzone; development of new transportation routes should be avoided in order to minimize the number of significant impacts on wildlife; and, where practical, access roads should be closed. Roads, besides providing for a loss of habitats through the land they occupy, often dissect important habitats, causing uneven distribution of animal use which may mean that some high capability units will be lightly or not used. In addition, feeding sites are often separated from cover by the improper location of roads and railroads.

All terrain vehicle use, while not as intensive as in the lower ecological unit, is an important disturbance factor, particularly in units adjacent to the urban centres. Regulations, restrictions and enforcement must be implemented in areas of winter ranges in order to reduce harassment during the winter and prevent destruction of valuable habitat during the summer. While off-road vehicle use will probably not affect the capability of the land to provide ungulate habitat it will reduce the ungulate use of that habitat through harassment and therefore the effect will be the same, that is, reduced ungulate populations.

Finally, land alienation can be a serious problem to ungulate use of this subzone. Serious planning and zoning must be implemented if migration corridors and winter ranges are not to continue to be fragmented. As with road construction, land alienation and subsequent land clearing and building construction affect the

capability of the land to produce ungulates both directly and indirectly. The direct loss of ungulate habitat is obvious. The indirect loss is more insidious and less definable, but often it can have just as serious deleterious effects on ungulate populations. In addition, management options on adjoining properties can be reduced.

5.5 WET EDAPHIC, CLIMAX VALLEY BOTTOM AREAS IN THE DRY INTERIOR REGION

5.5.1 Description of Area

Within the Dry Interior Region, development of a climatic climax vegetative cover that is typical of upland sites is not possible on excessively wet soils. In the floodplains and small riparian areas, edaphic climax communities are formed by willows, black cottonwood, Sitka alder, white spruce or western red cedar.

On gravel bars and areas that are frequently flooded, willow thickets may dominate and form an edaphic climax. These areas usually have high water tables and poorly aerated soils (Gleysolic and Gleyed Regosolic soils). Such areas are common along the Kootenay River and many of the smaller rivers within the mountains. Areas characterized by periodic flooding and well aerated, recently deposited soils (Regosolic soils) usually have stands dominated by black cottonwood and red-osier dogwood. Such areas are common along the Kootenay and Elk Rivers and near

the mouth of the St. Mary River.

On wide floodplains that are inundated infrequently, white spruce and black cottonwood provide the dominant forest cover and red-osier dogwood and common horsetail are dominant understory species. In early stages of succession these areas may have seral species such as willows and in areas of high base nutrient status, trembling aspen. The soils on such sites are commonly, moderately well-drained to imperfectly drained.

Lower slopes and valley floors that receive seepage from the adjacent slopes may be covered with stands of white spruce. The understory is usually dominated by common horsetail and moss. Lodgepole and Rocky Mountain Douglas-fir frequently act as seral species in these areas. These units have an enriched soil nutrient status caused by runoff from adjacent slopes. White spruce sites are generally restricted to the upper Kootenay and upper Elk rivers.

In depressional areas and valley floor areas with excessive moisture, various wetland communities are found. Fen communities, which are dominated by sedges, occur along the Columbia, Kootenay and Elk Rivers and in depressional areas throughout the study area. Marsh communities, dominated by cattails and other herbaceous vegetation, occur in wet nutrient rich sites. These communities grow in calcareous to mildly acidic soils, which are often capped with muck.



PLATE 5.5.1.1

The slow moving Kootenay River provides a wide variety of plant communities along its banks.

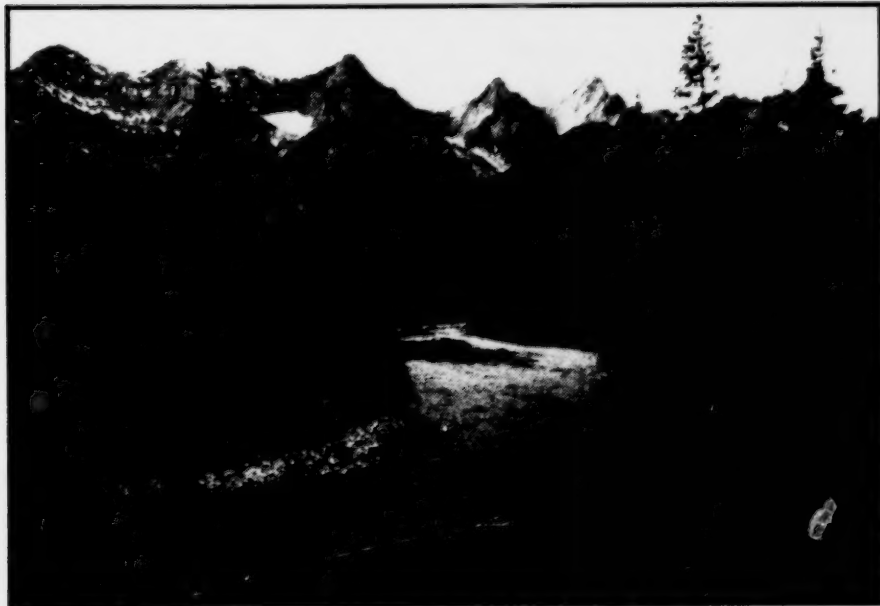


PLATE 5.5.1.2

The floodplains of the many rivers and creeks provide migratory cover for ungulates moving to and from winter and summer ranges. This is a photograph of the Elk River near Weary Creek.



PLATE 5.5.1.3

Many of the fast flowing mountain streams have sparse or poorly developed riparian plant communities. This is a photograph of the Albert River.



PLATE 5.5.1.4

In the East Kootenay, away from the flood plains of the Kootenay and Columbia Rivers, there are few marshes. This particular marsh is in the Flathead River Valley north of Howell Creek.

for moose occurs on the lower mountain slopes and glaciofluvial terraces of nearly all the river and stream valleys in the Lodgepole pine-whitebark pine subzone. Low capability summer habitat extends up-valley in the tributary valleys to many of the subalpine basins.

5.7.2.5 Bighorn Sheep

High capability bighorn sheep winter habitat occurs at several locations in the Lodgepole pine-whitebark pine subzone; the best sites are the high elevation - rough fescue grasslands in the Elk and Fording River valleys, and the south facing seral shrubland slopes in the Simpson River valley. Several other moderate capability bighorn sheep winter ranges occur in this subzone; these are usually lower elevation extensions of bighorn winter ranges that are centred on windswept slopes in the Krummholz subzone or the Alpine tundra zone. Several such sites exist on the Hughes and the Van Nostrand Ranges.

Many high capability bighorn sheep summer ranges exist on the more open, drier habitat in the Lodgepole pine-whitebark pine subzone. Such ranges are commonly downslope extensions of alpine, krummholz or sub alpine meadow summer range habitats. Timbered ridges and mountain slopes commonly provide access for bighorn migrating to and from low elevation winter ranges and alpine-like summer ranges.

5.7.2.6 Mountain Goats

Many mountain goat winter ranges occur in the Lodgepole pine-whitebark pine subzone. These usually occur on steep, rocky slopes and bluffs that have sparse forest cover. These winter ranges are commonly downslope from alpine-like habitats that can also serve as winter range or high capability summer ranges.

High capability summer ranges for mountain goats exist on the steeper, non-forested or poorly forested units of the Lodgepole pine-whitebark pine subzone. These ranges are almost always on mountains that also have krummholz or alpine-like habitats. In a few cases the Lodgepole pine-whitebark pine subzone is atypically open or alpine-like in plant community structure so that adequate mountain goat summer forage is available.

5.7.3 MANAGEMENT RECOMMENDATIONS

Logging and mining with their accompanying roads provide most of the land use conflicts. But coal mining on the High Rock Range could effectively destroy the unique high elevation - rough fescue grassland habitat which is used by bighorn. Also, unrestricted access to summer ranges in this subzone can cause severe disturbance to many of the wildlife species.

Logging should provide small clearcuts with a high edge-to-opening ratio. Selective logging may be the

Meadow communities are found in still other depressional areas and reflect locally increased moisture, usually from seasonally high water tables and seepage. These communities are dominated by herbaceous plants which root in mineral soils. Such soils commonly have a high organic matter content in the upper horizon.

Climate is variable throughout the valley bottoms of the Dry Interior Region. The Trench is warmer and has less snowfall and the side valleys are cooler with more snowfall. Thus, although such habitats are commonly similar in vegetative characteristics due to the wetness of the sites, wildlife capabilities may vary significantly due to variations in climate which affect the depth and duration of the snow pack. Depressional areas are subject to pooling of cold air. The degree of pooling (and subsequent minimum temperatures) reflects the extent to which a site is depressed. Hence exposure and local topographic variability also create significant climatic differences - even in valley bottoms. Sites that are near or on fluvial fans are often affected by night time cold air out-flows from tributary valleys.

5.5.2 UNGULATE SPECIES VALUES

5.5.2.1 Elk

Elk winter range capability is low in these habitats, because the snow tends to accumulate in these flat-lying sheltered areas. Most of the winter use would be during the

fall-early winter period.

These wetland areas provide some high capability summer habitat for elk, especially in the mountain valleys. Use of these areas will be from early spring to the late fall. The limited number of elk that summer in the Trench also occupy wetlands and the adjacent dry ponderosa pine forests. In addition, this habitat provides ideal terrain and cover to be used as migration corridors for animals moving between low elevation winter ranges and high elevation summer ranges.

5.5.2.2 Mule Deer

The capability to support mule deer during the winter in most of these habitats is low due to snow accumulation. These wetlands provide limited capability summer habitat for mule deer. Most of the use is as migration corridors for mule deer moving between low elevation winter ranges and high elevation summer range or as hiding cover.

5.5.2.3 White-tailed Deer

Limited capability exists within these wetlands to support white-tailed deer during the winter due primarily to deep, persistent snows that occur in this habitat.

Most of the wetland areas within the Interior Rocky Mountain Douglas-fir zone and the Rocky Mountain Douglas-fir-lodgepole pine subzone of the Subalpine Engelmann spruce-alpine fir zone are extremely high capability summer ranges for white-tailed deer. Excellent cover and forage is



PLATE 5.7.3.1

Logging in the Englemann spruce-subalpine fir zone often creates access to limited alpine areas which in turn can cause the ungulates using that area to vacate it for quieter habitats. The building of such roads should be avoided or, where necessary, they should be blocked off once the logging has been completed. This road is in Fenwick Creek in the Upper Kootenay River Valley.



PLATE 5.7.3.2

The building of roads in the tributary valleys of the Kootenay, Columbia and Elk River Valleys for logging purposes is the main cause of access development. In order to balance the public use of these areas and not to create undue disturbance to the foraging ungulates, it is imperative that many roads be closed once the logging has ceased.

provided in these habitats. These areas are also useful as migration corridors for animals moving between winter and summer ranges or when moving from one watershed to another.

5.5.2.4 Moose

Some high capability winter habitat for moose exists in the wetland areas that are located in the mountains, as deep or persistent snow is less limiting to moose (as compared to mule deer and white-tailed deer). The juxtaposition of the riparian habitats to terraces and lower mountain slopes characterized by moderately dense herb and shrub understories is ideal for providing cover and forage. Terraces and slopes adjacent to wetlands in the Trench are generally drier and not suitable as moose winter habitat. Some low capability winter habitat does exist within the Trench and in the deeper snowfall areas in the narrower valleys.

Some high capability summer habitat for moose exists within this ecological unit, primarily in the mountain valleys, which provide ideal forage and cover. Lower capability summer habitat occurs in the Trench and in areas that have developed to the conifer forest stages of succession. The wetland habitats also provide cover and terrain that is suited for moose that are migratory from one watershed to another or for movement up and down valley between winter and summer ranges.

5.5.3 MANAGEMENT RECOMMENDATIONS

These habitats primarily provide summer range requirements for white-tailed deer, moose and elk and winter range requirements for moose. They also provide excellent cover to be used as migration habitat for elk, moose, white-tailed deer and mule deer.

Land use problems are primarily land alienation, transportation corridor construction and water impoundments. Land alienation and its subsequent land clearing and building construction disrupts the continuity of the native cover. Road and railroad construction in this habitat-type often parallels the stream or river which exposes large portions of these units. As well, animal movement upslope across the road grade is impeded by the design of the road and the traffic on the road. Several reservoirs have been developed in this habitat-type; such water impoundments remove valuable habitat, and create barriers to cross-valley animal movements.

Logging of the riparian zone should proceed with the intention of maintaining a mature forest dominated by deciduous tree cover. Small clearcuts or selective logging are acceptable practices. Burning should be used to reduce forest and shrub competition in the marshes, and to rejuvenate decadent shrub stands - primarily willow stands.

Cattle grazing can be used to reduce the density of the sward, but may not be of any beneficial use to wildlife in this habitat.

Land use planning is necessary in order to reduce land alienation of

prescription of choice in mixed age/species stands. Slash in the clearcuts should be burned to provide easy mobility across the clearings. Riparian areas and adjacent terraces that provide movement corridors should be selectively logged or logged with small clearcuts. There should be no logging in areas adjacent to the high elevation rough fescue grasslands in the Elk and Fording River valleys, or adjacent to other bighorn or mountain goat winter ranges, as such forests provide necessary cover from deep snows prior to wind erosion and therefore must be maintained.

Wildfires on the drier, southerly facing slopes and ridges will have the effect of creating alpine-like conditions which are highly desirable ungulate summer habitat. Consequently wildfires should be allowed to burn in such cases. Bighorn sheep burn in such cases. Bighorn sheep and mountain goat winter ranges will be positively affected by burning; most have been burned in the past and have been maintained by the recurrence of wildfires.

As with other ecological units, planning of road and recreational access is of extreme importance to the distribution and behaviour of most ungulates. Roads create erosion problems and a direct loss of habitat as well dissecting critical habitats. Roads also create access problems since increased vehicle traffic disturbs ungulates and causes them to avoid areas of valuable habitat.

5.8 ALPINE-LIKE ENVIRONMENTS: KRUMMHOLZ SUBZONE OF THE SUBALPINE ENGELMANN SPRUCE- ALPINE FIR ZONE AND THE ALPINE TUNDRA ZONE

5.8.1 DESCRIPTION OF AREA

The alpine-like environments represent the highest forest subzones/zones in the East Kootenay. The lowest of these, the Krummholz subzone, represents the interface between the lower forested habitats and the upper, non-forested alpine habitats. This subzone is found between 2300 and 2450 metres. In addition to extreme climatic conditions and shallow soils, dessication due to direct exposure to the sun and strong winds further inhibits the establishment of trees (Figure 3.3).

Alpine fir is the dominant tree, while Engelmann spruce, whitebark pine and alpine larch are found in lesser amounts. At these elevations, trees grow in clumps, forming "islands" of stunted, layered trees interspersed amongst meadows, tundra, rock or talus.

The understory of krummholz-alpine vegetation is commonly dominated by grouseberry, mountain-heather, grasses and sedges. In drier areas with shallow soils and bare rock, the vegetation is dominated by white mountain-avens, woolly pussytoes, grasses and lichens. Moist sites are dominated by a herb layer of Sitka valerian, subalpine fleabane, and sedges.

Soils of the Krummholz subzone may be characterized by organic matter surface soil horizons that are associated with grassland vegetation. On active colluvial, or slumping slopes, Regosolic soils commonly



PLATE 5.5.3.1

Railroad beds located along the stream bank disrupts the continuity of the riparian area and creates a potential hazard for animals living in the area.



PLATE 5.5.3.2

Road locations adjacent to stream banks disrupts migration movements to and from winter and summer ranges.



PLATE 5.8.1.1

Krummholz forests are often not extensive in the East Kootenay, this is a view of a krummholz forest on Hungary Peak behind the Steeples.

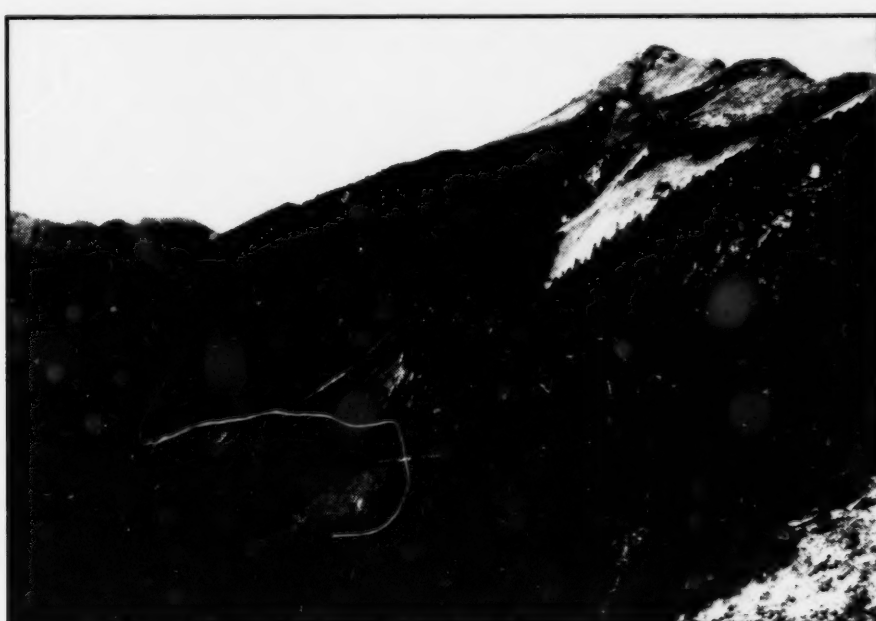


PLATE 5.8.1.2

The demarcation amongst the Lodgepole pine/white-bark pine subzone, the Krummholz subzone and the Alpine zone is not clear where avalanche tracts destroy the forest cover; this is a view of the Mutton Creek Valley, below White Knight Peak.

important units; to reduce the impact of mining towns and camps on important habitats; and, to prevent further dissection of riparian areas by roads and reservoirs. Housing developments, roads and railroads should be constructed upslope from riparian areas in order to reduce the impact of the blocking of migration corridors. Cover should be left between such construction and the riparian habitat to provide sound and visibility barriers.

5.6 ROCKY MOUNTAIN DOUGLAS-FIR- LODGEPOLE PINE SUBZONE OF THE SUBALPINE ENGELMANN SPRUCE - ALPINE FIR ZONE

5.6.1 Description of Subzone

This subzone is the lowest subzone in the Subalpine Engelmann spruce-alpine fir zone and it occurs immediately above the Interior Rocky Mountain Douglas-fir zone. In the Rocky Mountain Trench this subzone occurs from 1350 to 2100 metres on the slopes of the Rocky Mountains and from 1350 to 1800 metres on the slopes of the Purcell Mountains. In the mountains, this subzone occurs from 1200 to 1650 metres. As well, this subzone occurs on the higher elevation valley bottom portions of many of the major rivers; of note are Flathead, Elk, Bull, Lussier, White, Palliser and Cross Rivers (Figure 3.3).

Principal surficial materials on the slopes above the Rocky Mountain Trench are coarse textured colluvium and rock outcrops, with minor amounts of morainal material. In the mountains coarse textured colluvium

and rock outcrops with minor amounts of morainal material occur on the mountain sides. In the valleys of the mountains the surficial materials also commonly include fluvoglacial and morainal deposits.

This subzone is characterized by a warm, moderately dry climate which more closely resembles that of the Lodgepole pine subzone of the Rocky Mountain Interior Douglas-fir zone than the cold, higher precipitation climate of higher elevations. Snow is persistent throughout the winter, and solar radiation on south facing aspects is not effective for snow ablation. On warm southerly facing slopes, Douglas-fir is the dominant seral tree species, while on more shaded aspects, lodgepole pine occurs throughout. Southerly facing slopes that are severely or repeatedly burned are dominated by trembling aspen with an understory of soopolallie and pine grass. Within this subzone, seral stands commonly have a shrub layer dominated by birch-leaved spirea, soopolallie and rose, and the herb layer is dominated by pine grass, kinnikinnick, heart-leaved arnica and northern twinflower.

At upper elevations and on the northerly facing aspects, dominant shrubs consist of smooth Pacific menziesia, Utah honeysuckle, twinberry honeysuckle and grouseberry. A continuous layer of moss is frequently present. On droughty sites on sandy or gravelly-textured terraces, lodgepole pine is the dominant seral tree species, with an understory of soopolallie and pine grass.



PLATE 5.6.1.1

Within the Rocky Mountain Douglas-fir/lodgepole pine subzone, Douglas-fir stands when burned often give way to a shrub/grass community dominated by trembling aspen. This site on Mount Broadwood was burned in 1931, the photo was taken in August, 1977.



PLATE 5.6.1.2

A community of paper birch, trembling aspen, white spruce and wild sarsaparilla.



PLATE 5.6.1.3

An immature forest of Douglas-fir and lodgepole pine in the lower Simpson River Valley.



PLATE 5.6.1.4

An immature forest of Englemann spruce and aspen near the mouth of Todhunter Creek in the Fording River Valley.

Soils in this subzone are similar to those in the Lodgepole pine subzone of the Rocky Mountain Douglas-fir zone and include both shallow solum soils over calcareous parent materials and deeper, more acidic soils weathered from non-calcareous bedrock. Soils weathered from fine grained bedrocks commonly feature clay enriched horizons and, being better able to retain nutrients and soil water, may be associated with a higher vegetative cover, usually dominated by aspen.

5.6.2 UNGULATE SPECIES VALUES

5.6.2.1 Elk

Within this subzone, high capability elk winter ranges only occur in the segments of the Elk Fording, Michel, Sage and Kishinena valleys that are commonly characterized by somewhat reduced depth of snowpack. Low to moderate capability winter ranges occur in many of the broad river valleys, primarily the Flathead, Wigwam, Elk, Fording, and White Rivers; these valleys are characterized by deeper snow packs. As well, there is an up-valley continuation of many winter ranges that are centred in the Interior Rocky Mountain Douglas-fir zone. Snow depth appears to be critical for the wintering of elk in this subzone as it reduces their ability to forage as well as reducing their mobility. In addition, the number of forage species suitable for winter grazing is reduced in the Rocky Mountain Douglas-fir/lodgepole pine subzone.

Some extremely high capability summer ranges for elk occur within this subzone and within the Lodgepole pine/whitebark pine subzone immediately above it. The high capability is due to the common occurrence of avalanche tracks and the lush vegetation associated with them. The best habitat in this subzone occurs within the mountains, as adjacent to the Trench only moderate use is made of this subzone in the summer due to higher temperatures and steeper terrain. However, the Trench area is valuable as late winter and late fall staging areas for migrating animals.

5.6.2.2 Mule Deer

Within this subzone high capability mule deer winter ranges only occur at Grave Lake and on Mount Broadwood; lower capability mule deer winter ranges occur in several valleys, namely Sage, Michel and Bighorn Creeks, Wigwam, Fording and White Rivers, and in the upper Kootenay River. Mule deer winter range capability within this subzone is generally limited by snowpack depth.

The Rocky Mountain Douglas-fir-lodgepole pine subzone provides some extremely high capability summer range for mule deer and together with the Lodgepole pine-whitebark pine subzone is the primary summer range for mule deer. The high capability is due to the presence of numerous avalanche tracks. As with the elk, the best habitat occurs within the mountains. In the Trench portion of

this subzone most of the mule deer use made is as spring and fall staging areas.

5.6.2.3 White-tailed Deer

Except for low capability winter ranges at Grave Lake, Michel Ridge and south of Britt Creek, this subzone is unsuitable as wintering habitat for white-tailed deer, due to the relatively deep snowpack.

On the lower slopes and terraces of the mountains the Rocky Mountain Douglas-fir-lodgepole pine subzone provides some excellent summer habitat for white-tailed deer. This is the highest elevation subzone providing high capability summer habitat for white-tailed deer. Conifer forest areas adjacent to wetland areas and avalanche tracks have high capability for summer range. In this subzone, on the mountain slopes adjacent to the Trench, there is very little high capability summer habitat for white-tailed deer.

5.6.2.4 Moose

In the mountain valleys of this subzone, forested areas adjacent to wetlands provide suitable winter habitat for moose. Capabilities are highest in the Flathead and Elk River valleys. Lower capability winter habitat occurs within areas of deeper snowfall in many of the smaller valleys, namely the White, Palliser, Fording, Wigwam and Bull Rivers, and Alexander, Michel, Lodgepole, Teepee and Mather Creeks.

In the mountains, high capability summer ranges, are provided for

moose in this subzone. The better habitat occurs on the moist site, lower slopes that are adjacent to wetland areas. The steeper, upper slopes in the mountains and in the Trench have very low capability as moose habitat.

5.6.2.5 Bighorn Sheep

Moderate bighorn sheep winter range capability within this subzone only exists on dry, southerly facing aspects, usually adjacent to where most of the wintering habitat occurs in the lower elevation Interior Rocky Mountain Douglas-fir zone. Isolated areas of moderate capability winter range habitat occur in the Fording valley and on steep rocky slopes at Bighorn Creek, Ram Creek, above Whiteswan Lake, and the White River. As well, several small, low capability winter ranges occur within other valleys in this subzone.

In the steeper portions of this subzone, both in the Trench and the Rocky Mountains, some high capability bighorn sheep summer habitat occurs, especially on the middle and upper portions of avalanche tracks. This subzone also provides transition habitat as the bighorn move from summer and winter ranges and as escape habitat for the rams.

5.6.2.6 Mountain Goats

Some high capability winter habitat for mountain goats occurs within the Rocky Mountain Douglas-fir-lodgepole pine subzone, usually on steep, southerly facing, cliffs and timbered bluffs. Another prerequisite is access via adjacent slopes

or ridges to krummholz and alpine-like habitats.

Very little mountain goat summer range habitat occurs within this subzone. The summer ranges that do occur are either adjacent to winter ranges or are steep upper slopes.

5.6.3 Management Recommendations

Most of the management problems in this subzone are related to either logging or open pit coal mining. These two activities create problems in the form of roads, and soil erosion. Two settlements are established within this subzone and at least one other is planned. All are associated with coal mining activities.

Logging can provide habitat diversity which will provide excellent habitat for elk, mule deer, moose and white-tailed deer. However, clearcuts generally should maintain a high edge-to-opening ratio. In the winter range habitats primarily for moose and elk, clear-cuts should be small in order to provide ungulates easy access to timber cover from feeding sites.

Road management planning is an essential component of resource management in this subzone. Roads present a problem by increasing human use of summer ranges causing ungulates to vacate large areas of acceptable habitat. Road construction also removes land from the production of habitat, as well as causing erosion problems and creating movement barriers to animals. Once logging operations in an area have

ceased, roads should be closed and even re-seeded in order to enable an area to become secluded for animal use again.

Steep, south facing mountain goat and bighorn sheep ranges should only be logged in winter with the use of light floatation equipment. On such sites, roads must be minimized as they cause severe disruption of habitat use and create potential erosion problems.

Burning is beneficial in improving the habitat of the steeper, southerly facing elk, mule deer, bighorn sheep and mountain goat ranges as well as moose winter ranges on more mesic south to west facing gentle slopes. Care should be taken to ensure that adequate cover is retained adjacent to the burns.

Most of this subzone is too steep or remote for livestock grazing. Grazing in the broad valleys will not necessarily be beneficial to wildlife and will not serve to "condition" the forage for ungulate use as similar grazing will in the dry subzones of the Interior Rocky Mountain Douglas-fir zone.

Land use planning for road location, townsite development and access to coal mine activity must be considered in order to lessen the impact on wildlife habitat and use of it. Poorly planned road construction and industrial activity will impact unnecessarily on the wildlife resources. Recreation access must also be planned and controlled in order to maintain ungulate use of important habitats.

5.7 LODGEPOLE PINE-WHITEBARK PINE
SUBZONE OF THE SUBALPINE
ENGELMANN SPRUCE ALPINE FIR
ZONE

5.7.1 DESCRIPTION OF SUBZONE

This subzone ranges from 1800 to 2300 metres in the Rocky Mountain Trench and 1650 to 2300 metres in the mountains. On the warmer, southerly facing aspects of this subzone, the lower elevational limits are higher, and occur at about 2100 metres (Figure 3.3).

This subzone receives great amounts of snow which persist throughout the winter, longer on the northerly aspects. Strong winds on slopes perpendicular to the prevailing winds may remove most of the snow, much of which is deposited in depressional areas and on leeward slopes.

Below 2100 metres, on the mountain slopes, this subzone is usually characterized by closed stands of seral lodgepole pine and some western larch. On steeper, rapidly drained soils, the forests tend to open up and western larch is rarely present. On finer textured soils, western larch is commonly dominant over lodgepole pine in seral stands. Climax stands are characterized by alpine fir and Engelmann spruce.

The understory shrub layer of these stands is typically dominated by smooth Pacific menziesia, white-flowered rhododendron, black blueberry, twinberry honeysuckle, and grouseberry. Dominant herbs are heart-leaved arnica, northern twin flower and Canadian bunchberry. A moss layer is usually dominant.

Above 2000 metres on steep slopes seral stands of whitebark pine dominate but lodgepole pine and alpine fir are present, while grouseberry dominates the understory. On steep, southerly facing slopes, open stands of whitebark pine with an understory of soopolallie and rough fescue become established. Both these forests are moisture deficient for much of the summer due to an enhanced exposure to solar radiation and a rapid runoff of moisture.

Alpine larch is found at the upper limits of this subzone, generally above 2100 metres. It is often a pioneering species on recently deglaciated areas or on dry avalanche areas. On the more protected, high elevation sites, open to closed stands of climax alpine fir and Engelmann spruce become established. These stands have an understory dominated by white-flowered rhododendron, smooth Pacific menziesia and moss. Towards the upper limits of this subzone the forests tend to be open and are interspersed with meadow and alpine tundra communities.

On droughty, sandy or gravelly-textured terraces above valley bottom areas, lodgepole pine forests become dominant. The understory usually consists of soopolallie and pine grass. Tree growth is slow, and the climax tree species are slow to re-invade these sites.

Trembling aspen becomes dominant on steep southerly facing slopes that have been repeatedly burned. The more severely burned areas lack tree cover and are dominated by shrubs such as soopolallie, common Saskatoon and birch-leaved spirea. The herb



PLATE 5.7.1.1

Avalanche tracts are most common in the lodgepole pine/white-bark pine subzone. In the toe of an avalanche chute, where there is an accumulation of moisture, a lush forb/shrub community usually develops.



PLATE 5.7.1.2

Alpine larch can become established at the upper elevations of the lodgepole pine/white-bark pine subzone and can mingle with alpine fir in the krummholz subzone.



PLATE 5.7.1.3

In the Fording River Valley, edaphic rough fescue grasslands are established on some of the southerly facing slopes in the lodgepole pine/white-bark pine subzone. These grasslands are very important for bighorn sheep and elk, especially during the winter months.



PLATE 5.7.1.4

A community of alpine fir, white-flowered rhododendron, grouseberry and Sitka valerian.

layer is dominated by rough fescue, pine grass and fireweed.

The soils of this subzone are usually somewhat leached and the surface soils are commonly acidic. Finer textured soils commonly feature a clay enriched horizon. Podzolic soils are typical of this subzone, even on calcareous parent materials.

5.7.2 UNGULATE SPECIES VALUES

5.7.2.1 Elk

Within the Lodgepole pine-whitebark pine subzone high value winter habitat for elk occurs only in the south facing, rough fescue grasslands in the Fording River valley, and on the glaciofluvial terraces of Michel Creek. Low capability elk winter habitat exists in many river valleys, primarily as up-valley extensions of winter ranges that are centred in the Rocky Mountain Douglas-fir-lodgepole pine subzone. These winter ranges occur in the Flathead, Elk and Fording River valleys. Small and isolated winter range habitat occurs in the upper Simpson River valley.

This subzone provides excellent summer habitat for elk. Both it and the lower elevation, Rocky Mountain Douglas-fir-lodgepole pine subzone, provide most of the elk summer habitat.

5.7.2.2 Mule Deer

Some low capability winter habitats for mule deer exist in many river valleys. These sites are

usually up-valley extensions of winter ranges that are centered in the lower elevation, Rocky Mountain Douglas-fir-lodgepole pine subzone.

The Lodgepole pine-whitebark pine subzone provides high capability summer habitat for mule deer; both it and the lower elevation Rocky Mountain Douglas-fir-lodgepole pine subzone forms the basis for mule deer summer range in the study area.

5.7.2.3 White-tailed Deer

A limited amount of high quality white-tailed deer summer habitat exists in the Lodgepole pine-whitebark pine subzone, primarily in the Elk and Fording River valleys and Teepee and Gold Creek valleys. Low capability habitat exists in the riparian areas and adjacent glaciofluvial terraces in many of the stream and river valleys in this subzone. Such habitats are commonly used as migration corridors when white-tailed deer move from one watershed to another.

5.7.2.4 Moose

High capability winter range for moose exists in the Elk River valley in the Lodgepole pine-whitebark pine subzone up-valley from the Rocky Mountain Douglas-fir-lodgepole pine subzone. Low capability moose winter range exists in the mountain slopes and glaciofluvial terraces adjacent to riparian habitat in all the major river valleys and most of the smaller valleys.

High capability summer habitat



PLATE 5.8.1.3

Basins in the alpine/subalpine zone are complex due to cold air pooling, shading, snow accumulation and wind exposure; this is view of Outlook Creek Basin on Goat Haven Mountain.

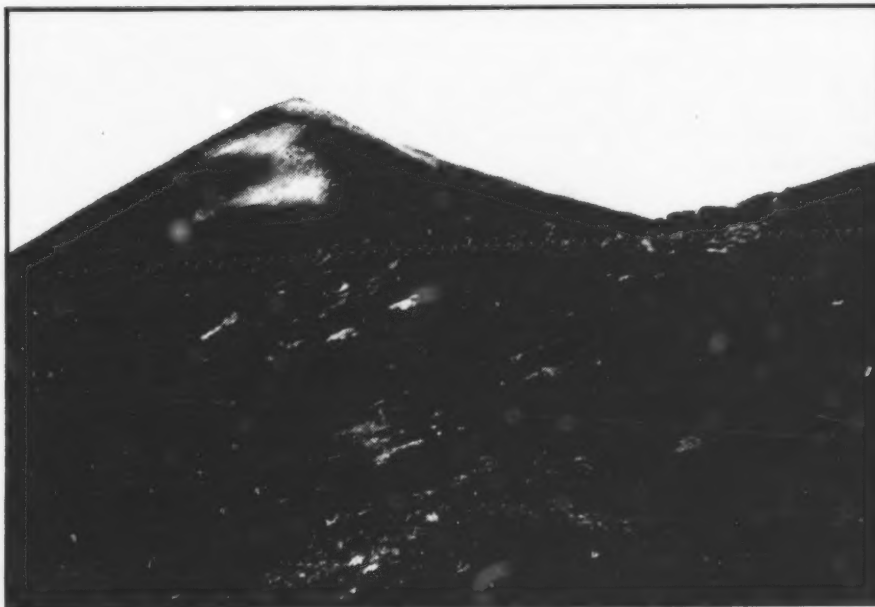


PLATE 5.8.1.4

Much of the alpine communities in the East Kootenay are poorly developed and bare rock often dominates; this is a photograph of Teepee Mountain on Diorite Ridge.



PLATE 5.8.1.5

The alpine habitat is rugged and dissected by rock faces and talus slopes, this is a view of Ptarmigan Lake from the White Knight-Edwards Peaks Ridge.



PLATE 5.8.1.6

The alpine basins and mountains in the Mount Assiniboine Provincial Park contains some of the most extensive and varied alpine-tundra communities in the East Kootenay study area.

occur. Much of this subzone is characterized by bedrock, and soils that do exist are most commonly shallow. However, because of higher precipitation, a late snow melt, and lower temperatures which lead to lower evaporation rates the soil characteristics of wet sites are relatively common.

Above about 2450 metres, the treeless or Alpine tundra zone becomes established. Moisture availability exerts a strong influence on the type of vegetation found in the alpine tundra. On rapidly-drained, drier sites, white mountain-avens, alpine bluegrass, moss campion and lichens are common. On average sites dwarf willows, mountain-heather, broad-leaved willowherb and mountain forget-me-not are commonly found among other herbs and grasses. On moister sites, vegetation is similar to subalpine meadows, with subalpine fleabane, Sitka valerian, and sedges.

Much of the alpine habitat consists of steep rocky slopes, which has either fragmented talus-like rock or rocky cliffs. The higher mountains have less vegetation and more exposed rock than the lower mountains. Where a veneer of soils occur, low vegetation is usually present.

The soils of the Alpine zone are commonly characterized by dark surface horizons and relatively immature soil developments reflecting slow decomposition of organic matter and limited soil weathering in this cold environment. Active colluvial slopes are usually characterized by Regosolic soils. Soils are most commonly shallow over bedrock.

Wet, treeless subalpine meadow communities can occur at high elevations (above 2200 metres) where melting snow provides ample moisture. Long snow duration and low temperatures inhibit tree growth and promote the growth of a dense sward of herbs and sod forming grasses and sedges. Diamond willow and glandular birch often dominate the shrub layer.

Large areas of subalpine meadows are found in the Og-Magog Lakes basin and in cirque basins and depressions throughout the higher altitudes of the mountains. Avalanche chutes often have subalpine meadow-like vegetation in areas that would otherwise be densely forested.

The climate of the alpine and similar areas is the harshest in the study area. Deep snow (depending on topography and exposure to the winds), persistent freezing, and strong bitter winds characterize the winter period; while during the summer strong dry winds, a high rate of evaporation, increased exposure to solar radiation and cool temperatures prevail.

5.8.2 UNGULATE SPECIES VALUES

5.8.2.1 Elk

This ecological unit provides some extremely high capability elk summer range particularly in the subalpine meadows and avalanche tracks. Moderate summer habitat capability for elk exists on the rolling or gently sloping sites that have moderate soil development. Low to poor summer habitat capability for elk exists on the dry, steep, rocky sites or active colluvium sites.

5.8.2.2 Mule Deer

This ecological unit provides some extremely high capability mule deer summer range habitat, particularly in the meadows and avalanche tracks. Moderate summer habitat capability for mule deer exists on the rolling or gently sloping sites that have moderate soil development. Low to poor summer habitat capability for mule deer exists on the dry, steep, rocky sites or active colluvium sites.

5.8.2.3 White-tailed Deer

Although the possibility exists for some white-tailed deer to appear in the Krummholz subzone and Alpine tundra zone, either as migrants or wandering individuals, this ecological unit has virtually no capability to sustain populations of white-tailed deer.

5.8.2.4 Moose

This ecological unit provides extremely limited capability for summer use by moose, except in the moist meadow sites. Use by moose of the Krummholz subzone or the Alpine tundra zone is commonly limited to migrants or wandering individuals; therefore, these habitats have virtually no capability to sustain populations of moose.

5.8.2.5 Bighorn Sheep

Some high and moderate capability winter habitat for bighorn sheep exists in these alpine-like environments. These winter ranges are typically windswept in the winter but

also have a dense sward of alpine-like vegetation. Only a few such sites exist in the East Kootenay study area, namely on the Elk, Van Nostrand and Hughes Ranges, Quartz Hill, Erickson Ridge, Sheep Mountain and Mount Peck. Size of the site, availability of adjacent escape terrain and snowdepth on surrounding habitats are important factors which can limit the size of the bighorn sheep herd that can be supported.

The best summer habitat for bighorn sheep in the East Kootenay study area occurs in the alpine-like environment. The rugged, dry sites are better suited as escape terrain; the meadows and the rounded gently sloping sites that have moderate soil developments are ideal foraging sites while the krummholz "forests" provide some hiding cover.

The only prerequisite to the use by bighorn of various sites within this ecological unit is their proximity to winter ranges. Some potentially excellent bighorn sheep summer range habitat will always be devoid of animals because there are no adjacent winter ranges. The Park Ranges are typically devoid of winter range habitat, and even though they have an abundance of alpine-like vegetation, they have not been classified as having bighorn sheep summer habitat capability.

5.8.2.6 Mountain Goats

High and moderate capability mountain goat winter ranges occur within the alpine-like ecological unit. Most of the winter range habitat within the East Kootenay study

area occurs in this ecological unit. Mountain goat winter range commonly consists of steep, rocky alpine-like areas where there is little snow accumulation or on windswept slopes with lush alpine vegetation, and which is adjacent to steep, cliffy areas. On mountain ranges where broad expanses of such habitats exist, large populations of mountain goats can occur. However, mountain goats can also be quite solitary in their habits; therefore small areas of this type of habitat can be the winter range for one or two animals.

In the East Kootenay study area mountain goat summer range capability exists throughout the alpine and alpine-like areas that are on, or are adjacent to steep, rocky, mountain slopes or cliffs. The exceptions are areas of rounded topography that have only krummholz vegetation; these areas have only moderate to poor summer range capability for mountain goats. The Galton Range is an example of an area with only fair summer range capability, as steep, rocky alpine-like habitat is not very extensive; while the McGillivray Range is an example of an area with no mountain goat capability even though it has rounded topography with krummholz vegetation, since it lacks continuous areas of steep, rocky alpine-like habitat.

5.8.3 MANAGEMENT RECOMMENDATIONS

There are few land use problems in this ecological unit, and those that occur relate to roads and mining activity. Mine exploration roads provide access for an increased number of people, which can result in

disturbance of animals in this habitat type. Mining is the only current activity which can actually destroy critical alpine habitat and remove it from use.

Wildfires should be allowed to burn in this alpine-like environment in order to retard tree encroachment and to reduce shrub invasion.

The most important management tool of the alpine-like environment is planning of developments that do occur. All roads to mine properties must be well located to avoid unnecessary habitat destruction and dissection of favourable habitats. Disturbance from recreationists can be controlled by road closures. The impacts of mining activities can be minimized by proper location of roads, construction sites, tailings and overburden removal. In addition, all road beds, tailing dump sites and mined areas should be landscaped and seeded to restore native alpine vegetation, so that they can become productive ungulate habitat once the areas have been stabilized.

5.9 INTERIOR WET BELT REGION

5.9.1 DESCRIPTION OF REGION

Within the East Kootenay study area the Interior wet belt region has three forest zones. These include: the Interior western hemlock-western red cedar zone; the Interior western red cedar zone; and the Subalpine Engelmann spruce-alpine fir zone. Although this forest region lies mainly in the West Kootenay, it extends into the southwestern part of the study area on the southwestern



PLATE 5.9.1.1

A forest stand in the Interior western hemlock - western red cedar zone that is dominated by western hemlock, western white pine and alpine fir.



PLATE 5.9.1.2

Much of the landscape in the Interior Wet Belt Region within the East Kootenay study area is gently rolling. This is a photograph of a subalpine ridge in the Perry Creek watershed.

part of the Yahk Ranges. Isolated areas of this forest region also occur in Little Van, Sand and Lizard Creek watersheds in the Rocky Mountains.

The Interior western hemlock-western red cedar zone is located from valley bottom upslope to approximately 1650 metres. An increase in precipitation with a corresponding increase in elevation allows western hemlock and western red cedar to dominate in mature forest stands above 1200 metres. This zone is located east of Moyie Lake, the Yahk River valley, Little Van, Lodgepole and Sand Creeks. In the Rockies, such areas are characterized by local increases in precipitation which are caused by the combined influence of surface air convergence and orographic lifting along the lower portions of properly oriented tributary valleys to the Trench.

Seral stands are dominated by lodgepole pine and western hemlock. Varying amounts of Douglas-fir, western larch, western white pine, paper birch and trembling aspen may grow within these seral forests. In the Interior western hemlock-western red cedar zone, on cool moist sites, alpine fir and Engelmann spruce are commonly seral, eventually being replaced by western hemlock and western red cedar. The understory is dominated by Oregon boxwood, western thimbleberry, birch-leaved spirea, northern twinflower and moss. At higher elevations the dominant shrubs are smooth Pacific manzanita, black blueberry and thin-leaved mountain alder.

The soils in this portion of the Purcell Mountains are most commonly leached and acidic as calcareous parent materials are uncommon. The cooler, moister environment of the Interior wet belt region results in Podzolic soil developments. Finer grained bedrocks and surficial materials are often characterized by soils with clay enriched horizons. However, in such a wet environment, both the coarse and fine textured soils are commonly characterized by relatively lush vegetative cover.

The Western red cedar zone is located from valley bottom to 1500 metres and in the study area is only found in the Lizard Creek watershed in the Elk valley. Seral stands consist of Rocky Mountain Douglas-fir, western larch and paper birch mixed with western red cedar. In moisture receiving sites, white spruce may be present. At higher elevations, Engelmann spruce and alpine fir form the seral tree species. Western hemlock is precluded from these sites due to the high calcareousness of the soils. Being located in the Rocky Mountains, the soils of the lower areas are commonly weathered from calcareous parent materials. However, areas of non-calcareous bedrocks and surficial materials are characterized by more leached and more deeply weathered soils. Finer grained bedrocks weather to fine textured soils that may be moister and feature a lush vegetative cover.

At lower elevations the understory is dominated by a shrub layer of Oregon boxwood, western yew and western thimbleberry and a herb layer

of northern twinflower, oakfern and heart-leaved arnica. At higher elevations the understory is dominated by smooth Pacific menziesia, black blueberry, and heart-leaved arnica.

The Subalpine Engelmann spruce-alpine fir zone within the Interior wet belt region occurs on the Yahk Ranges from about 1500 to 2300 metres. It is similar in composition to the Subalpine zone of the Dry Interior region although it is generally subject to greater precipitation.

Within the Interior wet belt region, seral stands are dominated by lodgepole pine and western larch. Often alpine fir, Engelmann spruce and Rocky Mountain Douglas-fir are present in the seral forests. The understory is dominated by smooth Pacific menziesia, black blueberry, white-flowered rhododendron, grouse berry, heart-leaved arnica and moss.

5.9.2 UNGULATE SPECIES VALUES

5.9.2.1 Elk

Very limited elk winter range capability exists in the Interior western hemlock-western red cedar zone of this ecological unit. The winter range habitats that do exist are commonly upslope extensions of winter ranges centred in the lower elevation Interior Rocky Mountain Douglas-fir zone.

Very high summer habitat capability for elk exists in the Interior wet belt ecological unit. Forests within this unit provide excellent cover and forage for elk summer use.

5.9.2.2 Mule Deer

Moderate to high summer habitat capability for mule deer exists in the Interior wet belt ecological unit. Forest canopies within this unit are commonly too closed, but there is an abundance of preferred mule deer forage being produced.

5.9.2.3 White-tailed Deer

Most of the habitat in the Interior wet belt ecological unit has only low capability to support white-tailed deer during the summer and no capability to support them during the winter. The better sites are commonly riparian areas that are up-valley extensions of favourable habitat that are centered in the Interior Rocky Mountain Douglas-fir zone.

5.9.2.4 Moose

Low capability moose winter range habitat exists in the Interior wet belt ecological unit. Such habitats are primarily in riparian areas or on low glaciofluvial terraces that are up-valley extensions of winter ranges which are centred in the lower elevation Interior Rocky Mountain Douglas-fir zone.

High and moderate summer range habitat for moose exists in the riparian areas and moister soils within the Interior wet belt ecological unit. The dry ridges, upper slopes and mountain tops are too high or dry to produce much favourable moose forage. Use of these upper elevation areas is generally transitory, or by animals passing from one watershed to another.

5.9.2.5 Mountain Goat

Very limited mountain goat summer habitat occurs within the Interior wet belt ecological unit within the study area. Only the drier, steeper, rocky sites that are down-slope extensions of favourable mountain goat habitat have the capability to be used. Such habitats were classified in the Van, Sand and Lizard Creek watersheds.

5.9.2.6 Woodland Caribou

No winter range habitat for woodland caribou was identified in the East Kootenay study area in this study. However, there is a possibility that some of the forested habitat within the Interior western hemlock-western red cedar zone could be of a low capability winter habitat.

Moderate capability caribou summer habitat exists within the Subalpine Engelmann spruce-alpine fir zone that occurs in the Interior wet belt ecological unit on the mountains west of Moyie Lake and Palmer Creek. The moister sites, riparian habitat and the red cedar forests were classified as being low capability summer habitat for woodland caribou.

5.9.3 MANAGEMENT RECOMMENDATIONS

The Interior wet belt region is fragmented within the study area; there are three forest zones and they are located in six different geographical locations. Management problems in each area are quite similar and relate to logging, road construction, and wildfire control.

Logging by clearcut methods would provide increased forage for elk, moose and mule deer in the Yahk Range south of the Moyie River. In this area wildfires on the mountain and ridge tops would stimulate krummholz-like vegetation which would be favourable for elk and mule deer.

In the woodland caribou habitat of the Yahk Range that lies west and north of Moyie Lake, a mature forest canopy should be maintained, clearcut logging should be prohibited and only selective logging should be considered. Wildfires should be controlled within this unit.

Road closures should be considered after logging has been completed, as all these habitats are valuable summer ranges and disturbance to foraging nursery herds of elk, woodland caribou, mule deer and moose will cause avoidance of these valuable foraging areas.

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